Figure 3.2 Vegetation Communities of the Subject Site

Table 3.1 Extent and Type of Vegetation on the Subject Site

Vegetation Communities	TSC Act Status	EPBC Act Status	Area (ha)
Shale Hills Woodland	CEEC	not listed*	11.1
Shale Plains Woodland	CEEC	not listed*	3.9
Alluvial Woodland	EEC	not listed	3.1
Exotic Grassland	not listed	not listed	31.4
TOTAL			**49**

see explanations in **Section 3.3*

CEEC = Critically Endangered Ecological Community; EEC = Endangered Ecological Community

The nomenclature of the vegetation communities used in this EIA largely follows NPWS NSW (2002) although equivalent names from the Biometric Vegetation Types database (OEH, 2012e) were used to compare site vegetation to benchmark values from the Vegetation Benchmarks database (OEH, 2008). The equivalencies in nomenclature are explained in **Table 3.2**.

Table 3.2 Equivalencies in Vegetation Community Nomenclature

Vegetation Community (NSW NPWS, 2002)	Biometric Vegetation Type (OEH, 2012)	Threatened Ecological Community listed under the TSC Act	Threatened Ecological Community listed under the EPBC Act
Shale Hills Woodland	[HN529] Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin	Cumberland Plain Woodland in the Sydney Basin Bioregion	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest
Shale Plains Woodland	[HN528] Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	Cumberland Plain Woodland in the Sydney Basin Bioregion	Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest
Alluvial Woodland	[HN526] Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin	River-flat eucalypt forest on coastal floodplains of the NSW North Coast, Sydney Basin and South East Corner bioregions	not listed
Exotic Grassland	no name provided	not listed	not listed

3.2 Vegetation Community Descriptions

3.2.1 Shale Hills Woodland

i. Landscape Position

Shale Hills Woodland is a grassy woodland community that occurs almost exclusively on soils derived from Wianamatta Shale. It is very similar to Shale Plains Woodland but typically occurs on steeper and more undulating terrain.

ii. Floristics Characteristic of the Community

Shale Hills Woodland is characterised by a canopy stratum dominated by *Eucalyptus moluccana* (Grey Box) and *Eucalyptus tereticornis* (Forest Red Gum) with *Eucalyptus crebra* (Narrow-leaved Ironbark) occurring less frequently (Tozer, 2003).

A small tree stratum is often present and frequently includes *Acacia implexa* (Hickory Wattle) together with a variety of the commonly occurring *Eucalyptus* species. Shale Hills Woodland typically has a shrub stratum dominated by *Bursaria spinosa* (Blackthorn) and more rarely includes other species such as *Acacia falcata*, *Breynia oblongifolia* (Coffee Bush), *Indigofera australis* (Australian Indigo) and *Dodonaea viscosa subsp. cuneata* (Wedge-leaf Hop-bush).

The ground stratum is variable in cover. A dense cover of grass and herb species is typical, but this may become quite sparse under a dense shrub cover of *Bursaria spinosa* (Blackthorn) or the exotic species *Olea europaea subsp. cuspidata* (African Olive). Species that can be found in the understorey include *Dichondra repens* (Kidney Weed), *Brunoniella australis* (Blue Trumpet), *Aristida ramosa* (Purple Wiregrass), *Desmodium varians* (Slender Tick-trefoil), *Microlaena stipoides var. stipoides* (Weeping Meadow Grass), *Themeda australis* (Kangaroo Grass) and *Cheilanthes sieberi subsp. sieberi* (Poison Rock Fern).

iii. Occurrence on the Subject Site

Shale Hills Woodland on the subject site is highly degraded from its original condition (**Photograph 3.1** and **Photograph 3.2**). The examples present on the subject site exist in a highly stressed state and continue to be heavily grazed and slashed. The canopy is largely represented by very young regeneration (i.e. 10 m tall, 10-15 cm diameter at breast height) surrounding one or two parent trees. The regenerating canopy trees in this woodland are in poor health and suffering from widespread crown dieback, possibly due to a recent psyllid outbreak (Catt, 2012; Western Sydney Parklands Trust, 2012).

The shrub layer is largely absent. Where present, the shrub layer is dominated by the pasture weed, *Sida rhombifolia* (Paddy's Lucerne) and *Solanum sisymbriifolium* (Sticky Nightshade), with infrequent occurrences of *Bursaria spinosa* (Blackthorn) in larger patches.

The understorey is now dominated by sub-tropical pasture grass species, including *Pennisetum clandestinum* (Kikuyu), *Cynodon dactylon* (Couch Grass) and *Paspalum dilatatum* (Paspalum). Few native herb species are present; those native herb species that are present tend to occur in very low frequencies (less than 5% of the overall ground cover).

Photograph 3.1 Shale Hills Woodland

Note: sparse understorey of Blackthorn and an overstorey of regenerating Forest Red Gum and Grey Box.

Photograph 3.2 Shale Hills Woodland

Note: canopy dieback of regenerating Grey Box trees and the heavily grazed understorey.

iv. Conformation to Threatened Ecological Community Listings

a. TSC Act

Shale Hills Woodland is formally included as part of the TSC Act listed community, Cumberland Plain Woodland in the Sydney Basin Bioregion. Cumberland Plain Woodland in the Sydney Basin Bioregion is listed under the TSC Act as a Critically Endangered Ecological Community (CEEC).

The TSC Act listing does not define condition thresholds that exclude stands of poorer quality from the listing. Although highly degraded, a biometric condition assessment shows that the Shale Hills Woodland present is considered to be in moderate to good condition (**Appendix B**). The TSC Act listing also recognises regrowth stands of shorter than 10 m tall with associated ground layers of reduced diversity and cover. Thus, although Shale Hills Woodland on the subject site is highly modified from its original condition, it still conforms to the TSC Act listing for Cumberland Plain Woodland in the Sydney Basin Bioregion.

The TSC Act listing for Cumberland Plain Woodland in the Sydney Basin Bioregion also includes native grasslands derived from clearing of the woodland canopy if characteristic non-woody species (as mentioned in the formal listing) are present. There are no examples of derived native grasslands containing characteristic non-woody species present on the subject site (see description of grasslands present on the subject site, **Section 3.2.4**).

b. EPBC Act

Not included in any EPBC Act listed community. See **Section 3.3**.

3.2.2 Shale Plains Woodland

i. Landscape Position

Shale Plains Woodland is a grassy woodland community that occurs predominantly on soils derived from Wianamatta Shale but it can also occur on Holocene alluviums in well-drained areas. It is very similar to Shale Hills Woodland but typically occurs on flatter and less rugged terrain. It is often found flanking the outer margins of riparian vegetation and will often shares some floristic characters with Alluvial Woodland and Shale Hills Woodland.

ii. Floristics Characteristic of the Community

Shale Plains Woodland is dominated by a canopy of *Eucalyptus moluccana* (Grey Box) and *Eucalyptus tereticornis* (Forest Red Gum) with *Eucalyptus crebra* (Narrow-leaved Ironbark), *Eucalyptus eugenioides* (Thin-leaved Stringybark) and *Corymbia maculata* (Spotted Gum) occurring less frequently (Tozer, 2003). *Eucalyptus amplifolia* (Cabbage Gum) can be present in low frequencies. These eucalypt species often form a separate small tree stratum, occasionally including other species such as *Exocarpos cupressiformis* (Cherry Ballart), *Acacia parramattensis subsp. parramattensis* (Parramatta Wattle) and *Acacia decurrens* (Black Wattle). A shrub stratum is usually present and dominated by *Bursaria spinosa* (Blackthorn).

Common ground stratum species include *Dichondra repens* (Kidney Weed), *Aristida vagans* (Threeawn Speargrass), *Microlaena stipoides var stipoides* (Weeping Meadow Grass), *Themeda australis* (Kangaroo Grass), *Brunoniella australis* (Blue Trumpet), *Desmodium varians* (Slender Tick-trefoil), *Opercularia diphylla*, *Wahlenbergia gracilis* (Sprawling Bluebell) and *Dichelachne micrantha* (Shorthair Plumegrass).

iii. Occurrence on the Subject Site

Shale Plains Woodland on the subject site is highly degraded from its original condition (**Photograph 3.3** and **Photograph 3.4**) and is subject to similar disturbances as Shale Hills Woodland. The examples present on the subject site exist in a highly stressed state and continue to be heavily grazed and slashed. The canopy is largely represented by very young regeneration (i.e. 10 m tall, 10-15 cm diameter at breast height) surrounding one or two parent trees. The regenerating canopy trees in this woodland are in poor health and suffering from widespread crown dieback, possibly due to a recent psyllid outbreak (Catt, 2012; Western Sydney Parklands Trust, 2012).

The shrub layer is largely absent. Where present, the shrub layer is dominated by the pasture weed, *Sida rhombifolia* (Paddy's Lucerne), with infrequent occurrences of *Bursaria spinosa* (Blackthorn) in larger patches.

The understorey is dominated by sub-tropical pasture grass species, including *Pennisetum clandestinum* (Kikuyu), *Cynodon dactylon* (Couch Grass), *Bromus catharticus* (Prairie Grass) and *Paspalum dilatatum* (Paspalum). Few native herb species are present; those native herb species that are present tend to occur in very low frequencies (less than 5% of the overall ground cover).

Photograph 3.3 Shale Plains Woodland near a drainage line

Note: regenerating Forest Red Gum and Grey Box trees and grazed understorey.

Photograph 3.4 Shale Plains Woodland in the western section of the subject site

Note: regenerating Cabbage Gum and Forest Red Gum trees over a grazed understorey.

iv. Conformation to Threatened Ecological Community Listings

a. TSC Act

Shale Plains Woodland is formally included as part of the TSC Act listed community, Cumberland Plain Woodland in the Sydney Basin Bioregion. Cumberland Plain Woodland in the Sydney Basin Bioregion is listed under the TSC Act as a CEEC.

The TSC Act listing does not define condition thresholds that exclude stands of poorer quality from the listing. Although degraded, a biometric condition assessment shows that the Shale Plains Woodland present is considered to be in moderate to good condition (**Appendix B**). The TSC Act listing also recognises regrowth stands of shorter than 10 m tall with associated ground layers of reduced diversity and cover. Thus, although Shale Plains Woodland on the subject site is highly modified from its original condition, it still conforms to the TSC Act listing for Cumberland Plain Woodland in the Sydney Basin Bioregion.

The TSC Act listing for Cumberland Plain Woodland in the Sydney Basin Bioregion also includes native grasslands derived from clearing of the woodland canopy if characteristic non-woody species (as mentioned in the formal listing) are present. There are no examples of derived native grasslands containing characteristic non-woody species present on the subject site (see description of grasslands present on the subject site, **Section 3.2.4**).

b. EPBC Act

Not included in any EPBC Act listed community. See **Section 3.3**.

3.2.3 Alluvial Woodland

i. Landscape Position

Alluvial Woodland is a grassy riparian woodland to open forest community with an open shrub layer and continuous groundcover of grasses and forbs. The distribution of Alluvial Woodland is restricted to the Hawkesbury-Nepean and Georges River systems on the Cumberland Plain; the community typically occurs in close proximity to minor watercourses and on alluvial flats draining soils derived from Wianamatta Shale.

ii. Floristics Characteristic of the Community

Alluvial Woodland is most often dominated by *Eucalyptus amplifolia* (Cabbage Gum) and *Eucalyptus tereticornis* (Forest Red Gum) with *Angophora floribunda* (Rough-barked Apple) occurring less frequently. Alluvial Woodland often includes a stratum of small trees, and frequently includes *Acacia parramattensis subsp. parramattensis* (Parramatta Wattle), *Casuarina glauca* (Swamp Oak), *Angophora floribunda* (Rough-barked Apple) and *Melaleuca decora* and *Melaleuca styphelioides* (Prickly-leaved Tea Tree). A shrub stratum is usually evident, but is often sparse and invariably dominated by *Bursaria spinosa* (Blackthorn).

Alluvial Woodland often has a dense ground cover dominated by grasses such as *Oplismenus aemulus* (Basket Grass), *Microlaena stipoides var. Stipoides* (Weeping Meadow Grass), *Entolasia marginata* (Bordered Panic) and *Echinopogon ovatus* (Forest Hedgehog Grass). Herb species are also common, including *Solanum prinophyllum* (Forest Nightshade), *Pratia purpurascens* (Whiteroot) and *Commelina cyanea* (Native Wandering Jew).

iii. Occurrence on the Subject Site

The occurrence of Alluvial Woodland on the subject site forms a narrow band of degraded riparian open forest along Reedy Creek. Much of the native species diversity is lost and replaced by woody weeds, exotic vines and pasture grasses (**Photograph 3.5** and **Photograph 3.6**). The Alluvial Woodland present on the subject site is frequently accessed by cattle and horses and show signs of grazing stress and trampling.

The shrub stratum is open and generally sparse but is dominated by woody weeds such as *Olea europea subsp. cuspidata* (African Olive), *Cestrum parqui* (Green Cestrum), *Sida rhombifolia* (Paddy's Lucerne) and *Lycium ferocissimum* (African Boxthorn).

The understorey is sparse and poorly diverse. It is dominated by exotic vines, including *Tradescantia fluminensis* (Wandering Jew), *Arauija sericifera* (Moth Vine) and *Lonicera japonica* (Japanese Honeysuckle).

Photograph 3.5 Alluvial Woodland along Reedy Creek

Note: canopy of Forest Red Gum and Cabbage Gum and an understorey of exotic vines and weedy shrubs.

Photograph 3.6 Alluvial Woodland along Reedy Creek

Note: understorey of African Boxthorn and Wandering Jew.

iv. Conformation to Threatened Ecological Community Listings

a. TSC Act

Alluvial Woodland is included as part of the TSC Act listed community, River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions. It is listed as an Endangered Ecological Community (EEC) under the TSC Act.

The TSC Act listing does not define condition thresholds that exclude stands of poorer quality from the listing. Although degraded, a biometric condition assessment shows that the Alluvial Woodland present is considered to be in moderate to good condition (**Appendix B**). The TSC Act listing recognises that River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions is a variable community that, due to partial clearing, can have a reduced canopy comprising scattered trees. The listing also recognises that due to its association with waterways and a high incidence of physical disturbance such as stock access and pollution runoff, there are very few examples of River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions that is unaffected by weeds.

As such, although the occurrence of Alluvial Woodland on the subject site is highly degraded, it is considered to conform to the TSC Act listed community River-flat Eucalypt Forest on Coastal Floodplains of the NSW North Coast, Sydney Basin and South East Corner Bioregions.

b. EPBC Act

Alluvial Woodland is not included within any EPBC Act listed community.

3.2.4 Exotic Grassland

The grassland areas of the subject site do not represent a natural grassland community. These grassland areas were created when areas of Shale Hills Woodland and Shale Plains Woodland were first cleared for grazing. Ongoing slashing, grazing and other agricultural activities have maintained the grasslands and prevented the regeneration of canopy trees and shrubs.

The grassland areas on the subject site are also predominantly exotic in composition and cover and are not considered to be native grassland derived from clearing of native woodland and forest. The original grasslands derived from the clearing of Shale Hills Woodland and Shale Plains Woodland would have been predominantly native in composition, and is likely to have included a diversity of grass and herb species such as *Dichondra repens* (Kidney Weed), *Brunoniella australis* (Blue Trumpet), *Aristida ramosa* (Purple Wiregrass), *Aristida vagans* (Threeawn Speargrass), *Desmodium varians* (Slender Tick-trefoil), *Microlaena stipoides var. stipoides* (Weeping Meadow Grass), *Themeda australis* (Kangaroo Grass), *Cheilanthes sieberi subsp. sieberi* (Poison Rock Fern), *Opercularia diphylla*, *Wahlenbergia gracilis* (Sprawling Bluebell) and *Dichelachne micrantha* (Shorthair Plumegrass).

Over many decades of disturbance, and with additional pasture improvement with subtropical grass species, the floristic composition of the grassland on the subject site was permanently altered. The current grassland areas on the subject site are largely dominated by subtropical pasture species, including *Pennisetum clandestinum* (Kikuyu), *Paspalum dilatatum* (Paspalum), *Cynodon dactylon* (Couch Grass) and *Bromus catharticus* (Prairie Grass). A few native grass species are present but occur in very low frequencies (less than 5% of the overall ground cover) and include *Eragrostis leptostachya* (Paddock Lovegrass), *Lachnagrostis filiformis* and *Dichelachne crinita* (Longhair Plumegrass). There is also a general absence of native herbs; the herb species that were recorded frequently are represented by exotic pasture weeds such as *Plantago lanceolata* (Lamb's Tongue), *Senecio madagascariensis* (Fireweed), *Verbena bonariensis* (Verbena), *Cirsium vulgare* (Spear Thistle) and *Conyza bonariensis* (Common Fleabane).

Photograph 3.7 and **Photograph 3.8** below show typical grassland areas on the subject site.

Photograph 3.7 Exotic Grassland dominated by Kikuyu and Couch Grass

Photograph 3.8 Exotic Grassland understorey

Note: the lack of native herb species and native grasses.

i. Conformation to Threatened Ecological Community Listings

a. TSC Act

The TSC Act listing for Cumberland Plain Woodland in the Sydney Basin Bioregion includes native grasslands derived from clearing of the woodland canopy if characteristic non-woody species (as mentioned in the formal listing) are present. There are no examples of derived native grasslands containing characteristic non-woody species present on the subject site.

Furthermore, a biometric condition assessment shows that the grassland areas present on the subject site are considered to be in low condition (**Appendix B**).

Therefore, no area of grassland on the subject site is considered to be threatened under the TSC Act.

b. EPBC Act

Not included in any EPBC Act listed community.

3.3 Cumberland Plain Woodland Listing under the EPBC Act

Shale Hills Woodland and Shale Plains Woodland are formally included within the EPBC Act listed community known as 'Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest'. Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest is listed under the EPBC Act as a CEEC.

The EPBC Act listing includes condition thresholds that define when a patch of Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest no longer retains sufficient conservation values to be considered as part of the listing. Using the decision flowchart provided in the policy statement for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest (SEWPAC, 2010, p. 11), it is determined that the occurrences of Shale Hills Woodland and Shale Plains on the subject site no longer conform to the EPBC listed Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. This is primarily due to the condition of the understorey, which is dominated by exotic perennial species and no longer retains at least a 30% foliage cover of native species.

Therefore, Shale Hills Woodland on the subject site does not conform to the EPBC Act listed community Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest.

3.4 Habitat Assessment

The subject site has a long history of agricultural land use. The native woodland and forest was heavily cleared in the past to provide pasture for livestock. Slashing, grazing and pasture improvement activities have maintained large open areas of grassland dominated by pasture grasses.

The subject site experiences a high level of ongoing disturbance and now provides habitat of limited value for native flora and fauna. The four main habitat types found on the subject site include:

- Regenerating woodland in small patches across the subject site;
- One narrow riparian corridor along Reedy Creek;
- Aquatic habitat in various farm dams and within Reedy Creek;
- Open exotic grassland across the subject site.

These are discussed in more detail below.

3.4.1 Regenerating Woodland

The native woodland vegetation remaining on the subject site is represented by a mosaic of regenerating patches of open forest and woodland at various stages of canopy regeneration. These woodland patches are characterised by the following attributes:

- Small patch size (less than 5 ha);
- Poorly connected to larger, more intact bushland;
- Moderately dense thicket of young trees (the majority of which are approximately 10-15 cm in diameter at breast height) around one or two large parent trees;
- Few hollows; hollows are only present on the large old growth trees;
- A sparse shrub layer;
- A predominantly exotic ground cover of exotic pasture grasses;
- Lack of native tussock grasses;
- Few fallen logs or other timber debris; and
- A very open and structurally simple understorey.

The regenerating canopy trees appear to be experiencing a degree of dieback of the canopy foliage (see **Photograph 3.2**). Due to their age and health, these trees are unlikely to flower reliably or abundantly at the present time and are highly unlikely to supply hollows for arboreal fauna. This makes the site largely unsuitable for blossom feeders and hollow-using species.

The understorey is structurally simplified as there are few shrubs, and any timber debris has largely been removed (see **Photograph 3.1** to **Photograph 3.4**). This limits the availability of foraging habitat for small fauna such as woodland birds and affords little protection from feral predators that have been recorded on the subject site such as Red Fox (*Vulpes vulpes*). There is also a lack of native tussock grasses that provide a degree of complexity to the ground stratum for small ground foraging fauna. The woodland patches are also accessed by cattle and horses and as a result the understorey vegetation is heavily grazed; and the growth of many grass and shrub species is suppressed and recruitment of native species is limited.

The regenerating woodland patches, due to their small patch sizes, have little interior habitat to support native fauna. These patches are also largely isolated from other significant patches of woodland habitat off site and therefore have limited connectivity value.

3.4.2 Riparian Woodland

The riparian woodland occurs as a narrow and interrupted band of vegetation along Reedy Creek (see **Photograph 3.5**, **Photograph 3.6** and **Photograph 3.9**). The quality of the riparian woodland is relatively poor for the following reasons:

- Historically cleared, limiting width of the woodland along the creek;
- Clearing has also simplified the understorey and removed most of the native vegetation that would have provided sheltering and foraging habitat for native fauna;
- The canopy trees, whilst mature, are relatively young and provide few hollows for native fauna;
- Grazing and trampling due to regular access by cattle has degraded the banks of the creek and kept the understorey relatively open;
- Easily accessed by feral fauna; and
- Isolated from other significant patches of woodland habitat off site and therefore has limited value as a wildlife corridor.

The riparian woodland, due to its narrow width, simplified understorey and configuration, has little interior habitat to support native fauna. The understorey is largely cleared of native vegetation and is somewhat open, which limits the availability of refugia for small native fauna from feral predators. Notwithstanding this, some of the woody exotics such as *Lycium ferocissimum* (African Boxthorn) have potential to provide shelter and food resources for small native fauna (**Photograph 3.10**).

Photograph 3.9 The riparian woodland along Reedy Creek

Note: narrow configuration of riparian vegetation (background) and the large clearings.

Photograph 3.10 Weeds in the riparian woodland understorey

Note: some weeds such as African Boxthorn can form locally dense thickets and can provide some habitat for native fauna.

3.4.3 Aquatic Habitat

The aquatic habitats on the subject site are represented by Reedy Creek and two large dams. One dam was constructed in the eastern portion of the subject site and collects water flowing from the hill in the middle of the subject site. The western-most dam is the larger of the two dams and was constructed in proximity of Reedy Creek. A large stock-holding yard is located at the edge of this dam where relatively high numbers of stock have access to the dam. A third, smaller dam is located at the southern boundary of the subject site.

The dams and Reedy Creek are used by cattle and horses as watering points and are permanently open to livestock access. As a result, the dams and much of the Reedy Creek frontage on the subject site lack fringing vegetation and stags or other timber debris that provide habitat for aquatic fauna (**Photograph 3.11** to **Photograph 3.13**). Around the stock-holding yard, the presence of a high concentration of cattle has removed all of the ground cover around the western-most dam and Reedy Creek (**Photograph 3.14** and **Photograph 3.15**). There are some occurrences of *Eleocharis sphaceolata* in one of the dams that may provide some habitat for aquatic fauna but this vegetation is relatively limited (**Photograph 3.16**).

The aquatic environments are currently likely to have high nutrient loadings, especially from pasture runoff, cattle droppings and cattle carcasses located along the creek. It currently supports visiting waterbird species and most likely provides habitat for native turtles and eels. However, the dams and the creek are unlikely to support populations of native fish.

Photograph 3.11 **Typical stretch of Reedy Creek on the subject site with Alluvial woodland in the background**

Note: lack of fringing vegetation.

Photograph 3.12 Eastern dam

Note: lack of fringing vegetation.

Photograph 3.13 Western dam near stock holding yard

Note: lack of fringing vegetation.

Photograph 3.14 Western dam at the stock-holding yard

Photograph 3.15 Reedy Creek near the stock-holding yard

Photograph 3.16 ***Eleocharis sphaceolata*** **in the dam as habitat for fauna**

3.4.4 Exotic Grassland

The exotic grassland on the subject site provides little habitat for native fauna because of the following reasons:

- Large native tussock grasses, fallen logs and other timber debris that provides habitat for ground dwelling fauna are generally absent;
- Grass seeds for grassland birds and other ground foraging granivores because of heavy grazing by cattle and horses;
- Trees with significant hollows for arboreal fauna are generally absent;
- Shrubs that can provide food and sheltering sites are generally absent;
- It provides little to no connectivity value as a fauna movement corridor; and
- It is regularly slashed and continues to be heavily grazed.

A table summarising the attributes of each habitat type on the subject site is provided in **Table 3.3** below.

Table 3.3 Attributes of the Key Habitat Types that are Present on the Subject Site

Habitat Features and Disturbances	Regenerating woodland in small patches across the subject site	One narrow riparian corridor along Reedy Creek	Aquatic habitat in various farm dams and within Reedy Creek	Open exotic grassland across the subject site
Hollows	Very few hollows, only 1 of 4 woodland plots contained hollows within a 500m² area. The hollows in this plot were recorded on 1 tree.	Very few hollows, only 1 of 2 woodland plots contained hollows within a 500m² area. The hollows in this plot were recorded on 1 tree.	N/A	Unlikely to contain significant hollows; only one potential hollow-bearing stag sighted.
Old growth trees	On average, only one or two old growth trees per patch.	No old growth trees observed.	N/A	Absent.
Timber debris	Not abundant.	Not abundant.	Absent	Absent
Understorey complexity	Low. Mid-storey and small shrub cover is less than 10%.	Moderate. Some understorey habitat available from woody exotics. However, mid-storey and small shrub cover is less than 10%	N/A	Absent
Flowering resources from trees and shrubs	Likely to be scarce. Most trees are regenerating and therefore immature. Canopy dieback observed across woodland patches. Unlikey to produce reliable and abundant flowers at this time.	Mature trees present. Likely to be seasonally abundant. Some flowering and fruiting resources from woody exotics.	N/A	Absent
Native groundcover	<10% percentage foliage cover	<10% percentage foliage cover	N/A	<10% percentage foliage cover
Presence of fringing vegetation	N/A	N/A	No	N/A
Presence of aquatic vegetation	N/A	N/A	Limited. Some patches of *Eleocharis sphaceolata* present	N/A

Table 3.3 Attributes of the Key Habitat Types that are Present on the Subject Site

Habitat Features and Disturbances	Regenerating woodland in small patches across the subject site	One narrow riparian corridor along Reedy Creek	Aquatic habitat in various farm dams and within Reedy Creek	Open exotic grassland across the subject site
Water quality	N/A	N/A	Very turbid-likely to have high nutrient loading. Suitable for many waterbirds, common frogs, turtles and eels. Not likely to contain native fish.	N/A
Recruitment of canopy trees and tree health	Recruitment of new trees is possible but has been suppressed. Crown dieback in young regeneration is evident	Recruitment present. Trees are mature	N/A	No
Connectivity to significant areas of habitat offsite	Low	Low	Low	Low
Grazing effects and stock access	Heavily grazed. Understorey vegetation suppressed	Heavily grazed. Understorey vegetation suppressed	Heavily accessed by cattle. Some areas of creekline and dam are bare of vegetation.	Heavily grazed. Recruitment of native herbs and native woody species not evident
Feral access	High counts of foxes	High counts of foxes. Black rats present.	High counts of foxes	High counts of foxes
Invasion by woody weeds	Moderate	High	Low	Moderate
Rubbish dumping	No	Yes	No	No

3.5 Flora of the Subject Site

3.5.1 General Assemblage

The flora assemblage of the subject site is typical of pasture properties in Western Sydney and is largely dominated by a number of pasture grass species, such as *Paspalum* spp., *Pennisetum clandestinum* (Kikuyu), *Setaria* spp., *Bromus catharticus* (Prairie Grass) and *Cynodon dactylon* (Couch Grass); and pasture weeds, like *Sida rhombifolia* (Paddy's Lucerne), *Cirsium vulgare* (Spear Thistle) and *Senecio madagascariensis* (Fireweed).

Approximately half of the diversity of flora species recorded on the subject site comprises introduced species. Exotic pasture species are the most frequently encountered species in the grassland areas of the subject site and a diversity of exotic scramblers and shrubs dominate the riparian woodland associated with Reedy Creek.

The native species present on the subject site comprise the remaining half of the species diversity recorded on the subject site. These native species, with the exception of the recovering canopy trees, occur very infrequently. Ground cover herbs and native shrubs are not common on the subject site.

3.5.2 Environmental Weeds

A number of exotic plant species present on the subject site are listed as a noxious weed under the *Noxious Weeds Act 1993* (NW Act) for Fairfield LGA (NSW DPI, 2013). Landowners must control any noxious weeds on their properties in accordance with control requirements listed for each noxious weed species. The noxious weeds recorded on the subject site are presented in **Table 3.4** below. **Table 3.4** includes the control class and associated control requirements for each noxious weed species.

Some of the species in **Table 3.4** are also declared a Weed of National Significance (WONS) by the Australian Government based on their invasiveness, potential for spread and environmental, social and economic impacts (Australian Weeds Committee, 2013). Whilst there are no control requirements specified for each WONS, it is expected that individual landowners and managers are ultimately responsible for managing these species. State and territory governments are responsible for the overall legislation and administration of weed management but must report to the Australian Weeds Committee on progress against any remaining actions under strategic plans where they are available for a specific WONS.

Table 3.4 Environmental Weed Species Recorded on the Subject Site

Family	Scientific Name	Common Name	WONS^/Declared Noxious (Fairfield LGA)	Control Requirements under the *Noxious Weed Act 1993*
Asparagaceae	*Asparagus aethiopicus*	Asparagus Fern	WONS	N/A
Asparagaceae	*Asparagus asparagoides*	Bridal Creeper*	WONS / Class 4 weed	The plant must not be sold propagated or knowingly distributed
Asteraceae	*Chrysanthemoides monilifera subsp. monilifera*	Boneseed*	WONS / Class 2 weed	This plant must be eradicated from the land and the land must be kept free of the plant
Asteraceae	*Senecio madagascariensis*	Fireweed	WONS	N/A
Cactaceae	*Opuntia stricta*	Prickly Pear	WONS / Class 4 weed	The growth of the plant must be managed in a manner that reduces its numbers, spread and incidence and continuously inhibits its reproduction and the plant must not be sold, propagated or knowingly distributed
Oleaceae	*Ligustrum lucidum*	Large-leaved Privet	Class 4 weed	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its flowering and reproduction
Oleaceae	*Ligustrum sinense*	Small-leaved Privet	Class 4 weed	The growth of the plant must be managed in a manner that reduces its numbers spread and incidence and continuously inhibits its flowering and reproduction
Solanaceae	*Cestrum parqui*	Chilean Cestrum	Class 3 weed	The plant must be fully and continuously suppressed and destroyed
Solanaceae	*Lycium ferocissimum*	African Boxthorn	WONS	N/A
Verbenaceae	*Lantana camara*	Lantana*	WONS / Class 4 weed	The growth of the plant must be managed in a manner that reduces its numbers, spread and incidence and continuously inhibits its flowering and reproduction and the plant must not be sold, propagated or knowingly distributed

*^Weeds of National Significance. *A strategic plan for this plant has been prepared by the Australian Weeds Committee.*

3.5.3 Threatened Flora Species

No threatened species listed under the TSC Act or EPBC Act were recorded on the subject site.

Atlas records show that a number of threatened plant species have been recorded in the locality of the subject site (OEH, 2013). Many of these species are found in larger areas of bushland like the Western Sydney Regional Park, Kemps Creek Nature Reserve and bushland immediately south of M4 and the existing quarantine station.

The results of ecological studies conducted for other nearby projects demonstrate that degraded sites with long agricultural histories similar to that of the subject site are no longer likely to support threatened plant species previously recorded in the locality, such as *Grevillea juniperina* (Juniper-leaved Grevillea), *Acacia pubescens* (Downy Wattle), *Dillwynia tenuifolia*, *Persoonia nutans* (Nodding Geebung) *Pultenaea parvifolia* and *Pimelea spicata* (Spiked Rice-flower).

The likelihood that threatened plant species are present on the subject site has been fully assessed and is presented in **Appendix D**. This assessment demonstrates that the subject site is unlikely to provide suitable habitat for threatened plant species known to occur in the wider locality.

3.6 Fauna of the Subject Site

3.6.1 General Assemblage

The faunal assemblage recorded on the subject site is dominated by common urban bird species. These are largely aggressive or territorial native birds that typically thrive in the urban-rural residential landscape and include Noisy Miner (*Manorina melanocephala*), Australian Raven (*Corvus coronoides*), Australian Magpie (*Cracticus tibicen*), Pied Currawong (*Strepera graculina*) and Red Wattlebird (*Anthochaera carunculata*). The subject site also provides habitat for a number of microchiropteran bat species that are common to the locality, such as Gould's Wattled Bat (*Chalinolobus gouldii*) and Eastern Broad-nosed Bat (*Scotorepens orion*). A small number of common frog species were recorded in association with the habitats around the dams and include the Common Froglet (*Crinia signifera*), Striped Marsh Frog (*Limnodynastes peronii*) and Spotted Marsh Frog (*Limnodynastes tasmaniensis*).

Only one small native arboreal mammal, the Common Brushtail Possum (*Trichosurus vulpecula*) was recorded during surveys of the subject site and only one native skink, the Common Garden Skink (*Lampropholis guichenoti*) was recorded. There is very little good quality habitat available on the subject site for small arboreal mammals, ground mammals and reptiles. Due to the high numbers of the feral Red Fox (*Vulpes vulpes*) observed during field survey, these species would also likely to be subject to high levels of predation if they occurred on the subject site as resident species.

3.6.2 Feral Species

The feral Red Fox (*Vulpes vulpes*) was observed in significant numbers on the subject site, presumably because of dead cattle and other potential food scraps. Other feral animals include European Rabbit (*Oryctolagus cuniculus*), Brown Hare (*Lepus capensis*), Black Rat (*Rattus rattus*) and Common Myna (*Sturnus tristis*). Such species are well established on the subject site and are relatively abundant.

3.6.3 Threatened Fauna Species

A small number of threatened and migratory fauna species were recorded on the subject site (**Table 3.5**). The threatened species recorded on the subject site are listed as Vulnerable species under the TSC Act. The migratory species recorded on the subject site are protected by international agreements under the EPBC Act and are discussed separately in **Section 3.6.4**.

Table 3.5 Threatened Fauna Species Recorded on the Subject Site

Family	EPBC Act	TSC Act	Scientific Name	Common Name	Detection Method
Ardeidae	Mi; Ma		*Ardea modesta*	Eastern Great Egret	Observed
Ardeidae	Mi; Ma		*Ardea ibis*	Cattle Egret	Observed
Accipitridae		V	*Lophoictinia isura*	Square-tailed Kite	Observed
Vespertilionidae		V	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	Echolocation Recording
Vespertilionidae		V	*Myotis macropus*	Large-footed Myotis	Echolocation Recording
Vespertilionidae		V	*Scoteanax rueppellii*	Greater Broad-nosed Bat	Echolocation Recording

V = Vulnerable; Mi = Migratory; Ma = Marine

i. Square-tailed Kite (Lophoictinia isura)

a. Breeding

The Square-tailed Kite (*Lophoictinia isura*) is monogamous and possibly bonds for life. The species generally selects nesting sites along or near watercourses, in the fork or on a large, horizontal limb of *Angophora* spp.or *Eucalypt* spp. (NSW NPWS, 1999).

b. Habitat

The Square-tailed Kite (*Lophoictinia isura*) typically inhabits the coastal forested and wooded lands of tropical and temperate Australia. The species is found in a variety of timbered habitats including dry woodlands and open forests and a particular preference for timbered watercourses.

In NSW, the Square-tailed Kite (*Lophoictinia isura*) is often associated with ridge and gully forests dominated by *Eucalyptus longifolia* (Woollybutt), *Eucalyptus maculata* (Spotted Gum) or *Eucalyptus elata* (Peppermint Gum). The species has also been sighted in forests containing other eucalypts, *Angophora* spp. and *Callitris* spp. with a shrubby understorey and Box-Ironbark woodland.

The Square-tailed Kite (*Lophoictinia isura*) preys predominantly on passerines although it is also known to prey on insects. It hunts in the canopy of trees in woodland and open forest and has a large hunting range of more than 100 km^2 (NSW NPWS, 1999; OEH, 2012d).

c. Threats

The major threats to the Square-tailed Kite (*Lophoictinia isura*) are (NSW NPWS, 1999):

- Loss of habitat through clearing and the activities associated with clearing, including intensive logging, burning, cultivation and grazing, particularly along water courses in the west;
- Illegal shooting and/or collection of eggs;
- Disturbance to nest trees; and
- Inappropriate fire and/or grazing regimes that reduce nesting and feeding resources.

d. Threat Abatement

The recommended threat abatement actions for the species are primarily focussed on the protection and maintenance of nesting trees along watercourses. The extent of protection zones should depend on the assessed habitat quality and/or presence of individuals at a site (NSW NPWS, 1999).

e. Use of the Subject Site

One individual Square-tailed Kite (*Lophoictinia isura*) was recorded flying over the subject site and was observed perching on a stag. It is possible that this individual was foraging over the subject site and adjacent properties; the subject site would form a part of a much larger foraging range for the species. There is potential breeding habitat for the species on the subject site, although the availability of timber along Reedy Creek is relatively limited.

ii. Microchiropteran Bats

Echolocation calls were recorded for a number of microchiropteran bat species. Of these, three call types belong to Vulnerable microchiropteran bat species listed under the TSC Act. One of these calls was positively identified to the Southern Myotis (*Myotis macropus*). Two other species were also tentatively identified from poorer quality echolocation recordings: Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*).

Although the Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) and Greater Broad-nosed Bat (*Scoteanax rueppellii*) were only tentatively identified from echolocation recordings, these species have been recorded a number of times elsewhere in the locality (see **Table 3.6**) and are likely to occur on the subject site from time to time.

a. Roosting/Breeding Habitat

All three bat species are known to roost in tree hollows. The Southern Myotis (*Myotis macropus*) is also known to roost in mine shafts, caves, road culverts and stormwater drains (Churchill, 2008).

b. Foraging Habitat

The Southern Myotis (*Myotis macropus*) has a strong association with permanent waterways and will forage over water, whilst the Eastern False Pipistrelle (*Falsistrellus tasmaniensis*) prefers tall and wet forests where the trees are more than 20 m tall and the understorey is dense. All three species are known to forage in open sclerophyll forest and woodland habitats. The Greater Broad-nosed Bat (*Scoteanax rueppellii*) is also known to prey on other microchiropteran bat species (Churchill, 2008).

c. Threats

The key threats identified for all three species is the loss of roosting and foraging sites due to the removal of hollow-bearing trees and remnant forest and woodland that provide foraging habitat. The degradation of waterways and stream quality, as well as changes to water regimes has also been recognised as an impact on food resources for these species (OEH, 2012c; OEH, 2012a; OEH, 2012b).

d. Threat Abatement

Recovery actions recommended for these species include the following (OEH, 2012c; OEH, 2012a; OEH, 2012b):

- Retain native riparian vegetation along streams and rivers and around other waterbodies;
- Minimise the use of pesticides adjacent to foraging areas and improve stream/water quality; and
- Protect roost sites from damage or disturbance and retain hollow-bearing trees where possible

e. Use of the Subject Site

The echolocation recordings were collected around the western dam during a warm night with high insect activity. All three of the above bat species were likely to have been foraging for insects around the western dam. No echolocation calls were recorded in other patches of woodland vegetation during the surveys, although it is likely that other patches of vegetation on the subject site would provide foraging habitat for microchiropteran bat species from time to time. The western dam is likely to be the focal foraging feature for the Southern Myotis (*Myotis macropus*) on the subject site.

Notwithstanding the above, the value of the subject site as foraging habitat is limited and all three species are likely to forage only occasionally over the subject site as part of a much larger foraging range. None of the bat species are likely to roost on the subject site because of the relative lack of roosting sites (i.e. tree hollows, caves, culverts, mine shafts etc).

iii. Other Potential Threatened Species

Atlas records show that a number of threatened fauna species have been recorded in the locality of the subject site (OEH, 2013). Many of these species are found in larger areas of bushland like the Western Sydney Regional Park, Kemps Creek Nature Reserve and bushland immediately south of M4 and the existing quarantine station.

The results of ecological studies conducted for other nearby projects demonstrate that degraded sites with long agricultural histories similar to that of the subject site are most likely to provide sub-optimal foraging habitat for wide-foraging species like raptors, migratory birds and bats (**Table 3.6**) but are unlikely to provide important roosting or breeding habitat for these species. Small native fauna like ground mammals, reptiles and woodland birds are unlikely to occur on these types of properties.

The likelihood that threatened fauna species are present on the subject site has been fully assessed and is presented in **Appendix D**. This assessment demonstrates that the subject site is likely to provide low quality foraging habitat for only a limited number of threatened fauna species known to occur in the wider locality.

Table 3.6 Threatened Fauna Species Recorded during other Ecological Studies in the Locality

Scientific Name	Common Name	TSC Act	EPBC Act	Ecological Study*														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
INVERTEBRATES																		
Meridolum corneovirens	Cumberland Plain Large Land Snail	E								X								
BIRDS																		
Ardea alba (syn. Ardea modesta)	Eastern Great Egret		Mi; Ma			X												
Gallinago hardwickii	Latham's Snipe		Mi; Ma			X												
Stagonopleura guttata	Diamond Firetail	V				P												
Hieraaetus morphnoides	Little Eagle	V							O									
Ardea ibis	Cattle Egret		Mi; Ma														X	
MAMMALS																		
Pteropus pliocephalus	Grey-headed Flying-fox	V	V	X														
Falsistrellus tasmaniensis	Eastern False Pipistrelle	V		X														
Miniopterus schreibersii oceanensis	Eastern Bentwing-bat	V		X										X				X

Table 3.6 Threatened Fauna Species Recorded during other Ecological Studies in the Locality

Scientific Name	Common Name	TSC Act	EPBC Act	Ecological Study*														
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Myotis macropus	Southern Myotis	V		X										X			X	
Scoteanax rueppellii	Greater Broad-nosed Bat	V		X														X
Mormopterus norfolkensis	Eastern Freetail-bat	V												X				X
Vespadelus troughtoni	Eastern Cave Bat	V																X

Note: Empty columns mean that no threatened fauna species were recorded during the ecological study

P = Potential; O = Overfly

E = Endangered; V = Vulnerable; Mi = Migratory; Ma = Marine

Ecological Studies

1. *Big W Warehouse. Report for the former Hoxton Park Airport Development (GHD, 2010)*
2. *Bungarribee Industrial Employment Lands (Huntingwood West) for Landcom (Eco Logical Australia, 2007)*
3. *Eastern Creek Business Hub. Ecological Assessment for the Eastern Creek Business Hub State Significant Development (Eco Logical Australia, 2012)*
4. *Eastern Creek Waste Facility. Flora, Fauna and Aquatic 2009 Impact Assessment: Cell 5 Northern Extension Landfill EC Stage 2 (Leonard et al., 2009)*
5. *Erskine Park Link Road. Terrestrial Ecology Assessment update for Ropes Creek realignment (Parsons Brinckerhoff, 2010)*
6. *Horsley Drive Business Park (SLR, 2012)*
7. *Light Horse Business Centre. Final Report ERM 2008 (ERM, 2008)*
8. *Old Wallgrove Road Widening (Roberts Road to Wallgrove Road) Eastern Creek (Aurecon, 2012)*

9. *Ropes Creek Industrial Estate. Lot 5 in DP 262213 Ropes Creek (Whelans InSites, 2010)*

10. *Sydney Water Growth Centres (Cumberland Ecology, 2011)*

11. *SWC Land in the Huntingwood Estate (Cumberland Ecology, 2009b)*

12. *Threatened Flora Assessment of Lot 1 DP 621472 Elizabeth Drive, Kemps Creek (Cumberland Ecology, 2007b)*

13. *708 Mamre Road, Kemps Creek (Cumberland Ecology, 2010)*

14. *Minchinbury Employment Park (Cumberland Ecology, 2009a)*

15. *Oakdale Concept Plan (Cumberland Ecology, 2007a)*

3.6.4 Fauna Species listed under the EPBC Act

Only two species listed under the EPBC Act were recorded on the subject site (see **Table 3.5**). The two species, the Eastern Great Egret (*Ardea modesta*) and Cattle Egret (*Ardea ibis*) are protected Migratory and Marine species included in international agreements. These are discussed in the following sections below.

No threatened species listed under the EPBC Act were recorded on the subject site. There is potential for some EPBC Act listed threatened species to forage over the subject site from time to time but the subject site does not provide valuable habitat for these species. Potential species are listed in a likelihood of occurrence assessment, which is provided in **Appendix D** of this EIA.

i. Cattle Egret (Ardea ibis)

a. Breeding

The species breeds in large colonies. In Australia the principal breeding sites are the central east coast from about Newcastle to Bundaberg. It also breeds in major inland wetlands in north NSW (notably the Macquarie Marshes). Breeding colonies have also been observed at Wyndham, Western Australia to Arnhem Land, Northern Territory (SEWPAC, 2013a).

b. Habitat

The Cattle Egret (*Ardea ibis*) occurs in tropical and temperate grasslands, wooded lands and terrestrial wetlands. It has occasionally been seen in arid and semi-arid regions however this is extremely rare. High numbers have been observed in moist, low-lying poorly drained pastures with an abundance of high grass; it avoids low grass pastures. It has been recorded on earthen dam walls and ploughed fields. It is commonly associated with the habitats of farm animals, particularly cattle, but also pigs, sheep, horses and deer. The species is known to follow earth-moving machinery and has been located at rubbish tips. It uses predominately shallow, open and fresh wetlands including meadows and swamps with low emergent vegetation and abundant aquatic flora. The species has sometimes been observed in swamps with tall emergent vegetation (Marchant and Higgins, 1990).

The Cattle Egret (*Ardea ibis*) often forages away from water on low lying grasslands, improved pastures and croplands. It is commonly found in cattle fields and other farm areas that contain livestock. The Cattle Egret has also been observed foraging in rubbish tips.

c. Threats

The major threats facing the Cattle Egret (*Ardea ibis*) are:

- Persecution of large colonies in urban areas;
- Loss of breeding habitats through wetland degradation and destruction; and
- Hunting, particularly in Nigeria where the bird is sold at traditional medicine markets.

In Australia exotic species, especially Feral Cats (*Felis catus*), is a major threat for many native birds. Cats are distributed across the entire country (including islands off the mainland). Due to their agility, climbing ability and stealthy characteristics they are able to seek prey in a diverse range of habitats. The Cattle Egret (*Ardea ibis*) roosts both in trees and on the ground in vegetation, making it particularly susceptible to predation by cats (SEWPAC, 2013a).

d. Threat Abatement

The Threat Abatement Plan for predation by feral cats (DEWHA, 2008) aims to protect affected wildlife and ecological communities as well as prevent more species and communities becoming vulnerable to the threat

e. Use of the Subject Site

The Cattle Egret (*Ardea ibis*) was recorded foraging in grassland habitat in association with cattle. The species is unlikely to occur on the subject site in significant numbers or to breed on the subject site.

ii. Eastern Great Egret (Ardea modesta)

a. Breeding

In Australia, the largest breeding colonies, and greatest concentrations of breeding colonies of Eastern Great Egret (*Ardea modesta*), are located in near-coastal regions of the Top End of the Northern Territory (SEWPAC, 2013b). Non-breeding populations can be found across most of Australia, except for the driest regions of the western and central deserts (Marchant and Higgins, 1990; McKilligan, 2005).

b. Habitat

Eastern Great Egret (*Ardea modesta*) has been reported in a wide range of wetland habitats (for example inland and coastal, freshwater and saline, permanent and ephemeral, open and vegetated, large and small, natural and artificial). These include swamps and marshes; margins of rivers and lakes; damp or flooded grasslands, pastures or agricultural lands; reservoirs; sewage treatment ponds; drainage channels; salt pans and salt lakes; salt marshes; estuarine mudflats, tidal streams; mangrove swamps; coastal lagoons; and offshore reefs (SEWPAC, 2013b).

c. Threats

In Australia, Eastern Great Egret (*Ardea modesta*) is threatened by loss and/or degradation of foraging and especially breeding habitat through alteration of water flows (for example harvesting of water for irrigation purposes that prevents or limits inundation of wetlands), drainage and/or clearing of wetlands for development, frequent burning of wetland vegetation used as nest sites, salinisation and invasion by exotic plants or fishes (SEWPAC, 2013b).

d. Threat Abatement

The most important issue for the conservation of the Eastern Great Egret (*Ardea modesta*) and other herons in inland regions of Australia is the allocation of water from regulated rivers in sufficient quantity and at appropriate times to maintain suitable wetland conditions (SEWPAC, 2013b).

e. Use of the Subject Site

The Eastern Great Egret (*Ardea modesta*) is likely to forage in the wetland environments provided by the dams from time to time. However, the species is unlikely to occur on the subject site in significant numbers or to breed on the subject site.

Chapter 4

Impact Assessment

4.1 Direct Removal of Threatened Ecological Communities

4.1.1 Area of Vegetation to be Cleared

The Project proposes to develop the subject site to accommodate a range of distribution and warehousing facilities. This will involve clearing the majority of the existing vegetation on the subject site. The estimated areas of clearance are summarised in **Table 4.1** below.

As part of the Project, a setback from Reedy Creek and its tributary (30 m and 20 m respectively) has been excluded from the development envelope. This area corresponds to the E2 zoning along the western boundary of the subject site and will not be cleared of vegetation for the Project. Other areas of remnant vegetation will also be retained, including a patch of vegetation in the south-east corner of the subject site.

The areas covered by the RMS road reserve and the Transgrid transmission line easement has been excluded from the assessment of the Project.

Table 4.1 Areas of Direct Vegetation Clearance Required by the Project

Vegetation Communities	TSC Act Status	EPBC Act Status	Area to be retained (ha)	*Areas excluded from assessment (ha)	Area to be removed (ha)	TOTAL within subject site (ha)
Shale Hills Woodland	Cumberland Plain Woodland CEEC	not listed	0.00	1.28	9.85	11.1
Shale Plains Woodland	Cumberland Plain Woodland CEEC	not listed	0.26	0.37	3.27	3.9
Alluvial Woodland	River-flat Eucalypt Forest EEC	not listed	1.02	0.61	1.43	3.1
Exotic Grassland	not listed	not listed	0.47	2.35	28.57	31.4
TOTAL (nearest ha)			**2**	**5**	**43**	**49**

CEEC = Critically Endangered Ecological Community; EEC = Endangered Ecological Community

**RMS road reserve and Transgrid transmission line easement*

4.1.2 Conservation Significance of the Vegetation to be Cleared

The native woodland on the subject site conforms to two different threatened ecological communities listed under the TSC Act:

- Cumberland Plain Woodland CEEC; and
- River-flat Eucalypt Forest EEC.

Cumberland Plain Woodland and River-flat Eucalypt Forest, like many communities on the Cumberland Plain, have been listed as threatened because they have undergone a very large reduction in their geographic distribution in a relatively short timeframe and are likely to become extinct if considerable effort is not made to conserve remaining occurrences. The Project proposes to clear approximately 13.1 ha of Cumberland Plain Woodland and approximately 1.4 ha of River-flat Eucalypt Forest and is therefore likely to have a significant impact on these communities.

Notwithstanding the above, the occurrences of Cumberland Plain Woodland and River-flat Eucalypt Forest on the subject site represent highly degraded examples of these communities, as evidenced by the alterations in community structure and composition, establishment of exotic species and degradation and fragmentation of habitat observed during field survey. The occurrences on the subject site are also very isolated from other areas of bushland by the M7 and M4 motorways and surrounding rural residential and industrial development.

The subject site has a long history of native vegetation clearing and is currently being used as a cattle and horse agistment. In the absence of the Project, continuing use of the subject site as an agricultural property will continue to degrade the on-site occurrences of Cumberland Plain Woodland and River-flat Eucalypt Forest. Since the subject site is located in the WSEA, which is an area targeted specifically for industrial development, it is reasonable to expect that future development of WSEA lands will further isolate the on-site occurrences from surrounding bushland in the long term.

Due to these reasons, the threatened ecological communities occurring on the subject site have poor capabilities and little opportunity for long term recovery. These occurrences are therefore unlikely to have high conservation significance in the long term.

In the locality of the subject site, significant areas of Cumberland Plain Woodland and River-flat Eucalypt Forest are being retained and conserved. These include the Western Sydney Regional Park, Kemps Creek Nature Reserve and woodland vegetation around Prospect Reservoir. Additional areas of sizable bushland supporting Cumberland Plain Woodland and River-flat Eucalypt Forest within adjacent precincts of the WSEA are also protected under E2 zone restrictions.

The Project, whilst having a significant impact on Cumberland Plain Woodland and River-flat Eucalypt Forest, is unlikely to have a significant impact on the overall persistence of these communities in the locality in the long term.

4.2 Direct Impacts on Threatened Species and Threatened Species Habitat

The subject site provides very low quality habitat for many native threatened species. No threatened plant species were recorded on the subject site. Due to the degradation of the subject site and ongoing grazing and slashing practices, the occurrence of threatened plant species is highly unlikely. The Project is unlikely to have a significant impact on threatened plant species or their habitat.

The subject site also provides very poor habitat for native threatened fauna species, particularly ground mammals, arboreal mammals, reptiles and small woodland birds. Notwithstanding this, more mobile threatened species that typically forage over a large area, such as threatened raptors and microchiropteran bats, are expected to forage within the subject from time to time as they move around the locality. However, due to the degradation of the subject site and the general lack of important habitat features such as tree hollows, these species are unlikely to roost or nest on the subject site.

The Project will remove a relatively small area of low quality foraging habitat for the Southern Myotis (*Myotis macropus*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*) and Square-tailed Kite (*Lophoictinia isura*). The Project will also remove low quality potential foraging habitat for a number of other threatened microchiropteran bat and raptor species recorded in the locality, such as Eastern Bentwing-bat (*Miniopterus shreibersii oceanensis*), Eastern Freetail-bat (*Mormopterus norfolkensis*) and Little Eagle (*Hieraaetus morphnoides*). The Project will not remove any known or important roosting or nesting habitat for any of these species.

Better quality foraging, roosting and nesting habitat will remain for these species in the locality of the subject site in bushland around Prospect Reservoir, in Kemps Creek Nature Reserve and in the Western Sydney Regional Park.

Considering all of the above, the Project is unlikely to have a significant impact on threatened fauna species or their habitat.

4.3 Indirect Impacts on Waterways and Riparian Vegetation

An area of vegetation within the required riparian setback along Reedy Creek will be retained as part of the Project. This area is not proposed to be cleared under the proposed Project; however, the Project has potential to indirectly impact on the vegetation and aquatic environments within the riparian zone if no mitigation or management measures are implemented.

The riparian area was historically cleared of much of its original vegetation and currently exists in a highly degraded state. Ongoing stock grazing and trampling, weed infestation, cumulative loss of interior habitat, high nutrient loadings and other such impacts will continue to degrade the woodland and associated aquatic environments for the foreseeable future. Nevertheless, the Project has potential further impact the riparian area along Reedy Creek in a number of ways, which are discussed below.

4.3.1 Increased Sedimentation and Erosion

During the construction of the Project, the adjoining vegetation and waterways have the potential to be impacted by sedimentation and erosion. An increase in the amount of sediment and eroded material can smother retained vegetation and pollute waterways if appropriate control measures are not implemented. Suitable erosion and sediment control plans will need to be implemented as part of the construction plans for the Project to mitigate any potential impacts in these areas.

4.3.2 Increased Edge Effects

Vegetation clearing on the subject site may increase edge effects on the adjacent riparian vegetation, including exacerbation of weed and feral fauna species. However, this is not likely to be significant because the riparian vegetation is currently degraded by weeds and feral fauna. Nevertheless, the Project can inhibit any future restoration efforts in the riparian zone if not managed adequately, as weed establishment can be prolific after soil disturbance events. Sedimentation and erosion during construction can move soil, pollutants and other materials (such as weed propagules) into the surrounding vegetation and edge effects may exacerbate their colonisation.

4.3.3 Downstream Impacts

The adjoining vegetation and waterways downstream have the potential to be impacted by sedimentation and erosion during construction. Beyond construction, there is potential for pollutants carried in dirty stormwater to be discharged into Reedy Creek, which would pollute waterways and adversely affect flora and fauna occurring within those waterways in the long term.

4.3.4 Potential for Improvement

If mitigation works are carried out in the riparian zone and ongoing management of this area takes place, then the biodiversity values of the riparian vegetation and the associated aquatic environments are likely to improve above its current condition.

4.4 Impacts on Matters of NES listed under the EPBC Act

The Project is not expected to have significant impacts on matters of NES listed under the EPBC Act. No World Heritage properties or National Heritage places are relevant to the subject site. No areas of internationally significant wetland as listed under the Ramsar Convention are relevant to the subject site.

No threatened flora or fauna species listed under the EPBC Act were recorded on the subject site and none are likely to rely significantly on the subject site such that the Project would have an adverse impact on the long-term survival, area of occupation or recovery of the species.

Two bird species recorded on the subject site are listed as migratory and marine species under the EPBC Act. These species are Eastern Great Egret (*Ardea modesta*) and Cattle Egret (*Ardea ibis*). These species are expected to forage within the subject from time to time as they move around the locality. However, the subject site does not comprise important foraging or breeding habitat for these migratory species and therefore the Project is unlikely to have a significant detrimental impact on these species.

The native woodland on the subject site that conforms to Cumberland Plain Woodland under the TSC Act is too degraded to meet the EPBC Act listing for Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest. No other vegetation communities on the subject site conform to any EPBC Act listed threatened ecological community. Therefore, the Project is unlikely to have a significant impact on threatened ecological communities listed under the EPBC Act.

Chapter 5

Impact Mitigation

5.1 Avoidance Measures

The Project has few opportunities to avoid impacts to threatened species habitat and threatened ecological communities. Although different design options were considered during the design phase of the Project, the current Concept Plan is considered to be the most feasible option.

Under a "do nothing" scenario that assumes that the current land uses continue, the biodiversity values of the remnant vegetation on the subject site are likely to continue to decline. The Project, although likely to remove 13.1 ha of Cumberland Plain Woodland and 1.4 ha of River-flat Eucalypt Forest, presents opportunities to improve the condition and value of the River-flat Eucalypt Forest that will be retained along Reedy Creek and its tributary. This is discussed further below.

5.2 Mitigation Measures

The current Concept Plan will retain vegetation within several areas of the subject site, including within the E2 zoned riparian setback along Reedy Creek and its tributary, and in the south-east corner of the subject site. No development works will take place in these areas excepting those activities permitted with consent within E2 zoning areas and landscape planting.

Although the Project will retain areas of vegetation on the subject site, the Project will still have potential to indirectly impact on this vegetation and on aquatic environments within the riparian zone. Considering this, a number of mitigation measures are recommended for the Project to minimise potential impacts to native flora and fauna during both the construction and operational phases of the Project.

Construction protocols and controls are strongly recommended during the construction phase of the Project that includes pre-clearance and dam decommissioning protocols to limit inadvertent impacts to native flora and fauna that may currently be residing on the subject site.

Ongoing management and improvement activities are recommended for the riparian area of the subject site under a coordinated riparian management plan to ensure that the biodiversity values of this area are not adversely impacted by the Project in the long term. This will also ensure that the objectives of the E2 zone "*to protect, manage and restore areas of high ecological, scientific, cultural or aesthetic values*" are achieved.

The landscape design and planting species for the subject site should consider incorporating elements of Cumberland Plain Woodland to ameliorate as far as possible the loss of endemic plant species and habitat for native fauna.

The implementation of a stormwater management plan is also recommended to manage the stormwater flows that enter Reedy Creek from the industrial areas of the subject site.

These measures are discussed below.

5.2.1 Construction Phase

i. Protocols to Avoid Unintended Disturbance

To ensure that construction is strictly limited to the development footprint and does not have secondary impacts on the riparian area, the following measures are recommended:

- Mark clearing limits to further reduce clearing extents and to retain potential habitat and other ecologically significant features at the edges of the clearing limits wherever practicable;
- Limit vehicular and plant equipment access to this area during construction;
- Install temporary fencing to mark the limits of clearing and "no-go" areas; and
- Construction staff informed with regards to the status and location of protected areas during site induction and/or tool box talks.

As construction methodologies are developed for the Project, attention would be given to opportunities to further reduce the risk of unintended disturbance.

ii. Pre-clearing Protocols

Where clearing of vegetation and fauna habitats will take place, pre-clearing and clearing protocols are recommended that include:

- Preparation of an inventory of trees and hollows to be removed, prior to clearing;
- Pre-clearance checks of hollow-bearing trees for the presence of bird nests and arboreal mammals, such as possums, gliders and bats, prior to felling;
- Safe removal of animals found to be occupying trees prior to the clearing of trees and their appropriate relocation into nearby woodlands; and

- Relocation of transportable features such as salvaged tree hollows, felled timber and large logs in the woodland areas to be retained to allow their continued use as fauna habitat.

iii. Dam Decommission

A dam drainage protocol is recommended for dam decommissioning to ensure that native wildlife residing within dams are not adversely impacted during construction. This involves the safe removal of animals to suitable alternate locations by a suitably qualified ecologist or wildlife carer, timing of decommissioning works to non-breeding seasons for appropriate target species and implementation of chytrid protocols for ecologists and machinery entering the water to limit the transmission of disease.

iv. Erosion Control

Suitable erosion and sediment control plans will be implemented as part of the Project to mitigate the impact of soil disturbance and to prevent secondary or off-site impacts, particularly impacts on adjacent native vegetation along Reedy Creek. It will also include measures to manage stockpiles of overburden to limit unintended soil movement away from designated compound areas into adjacent woodland.

All work sites should be constructed and managed in accordance with 'Managing Urban Stormwater: Soils and Construction' (Landcom, 2004, "Blue Book"). These guidelines detail the type and depth of erosion and sediment control measures. Through the effective implementation of these guidelines, potential impacts resulting from soil erosion and sedimentation will be mitigated.

In this regard, it is recommended that:

- Topsoils being stored for reapplication should be stabilised using a blanket type method; and

- Any topsoil that is reapplied should be stabilised by seeding using a grass species native to the Cumberland Plain.

5.2.2 Riparian Management Plan

Restoration and ongoing management of the riparian zone along Reedy Creek will be implemented as part of a riparian management plan to ensure that the Project does not have significant and adverse long term effects on the health of Reedy Creek and the biodiversity values of the associated riparian vegetation. Restoration objectives will be included as part of this riparian management plan to provide for the biodiversity improvement of the riparian corridor. The riparian management plan will include the following elements:

- Protection of the riparian corridor during construction;

- Restoration and ongoing management of riparian vegetation;

- Management of riparian vegetation as habitat for native wildlife;
- Feral animal management;
- Instructions for planting endemic species of local provenance
- Weed management;
- Reduction of sediment and nutrient delivery to waterways;
- In-stream erosion control;
- Fire management; and
- Monitoring and reporting protocols.

A number of useful guidelines are available that can assist in the preparation of the riparian management plan (e.g. Lovett and Price, 1999; Price and Lovett, 1999).

5.2.3 Landscape Plan

The future landscaping of the subject site has been designed to reintroduce strong elements of Cumberland Plain Woodland onto the subject site after construction is completed. The overall costs of these landscaping works will total approximately $1.1 million. The landscape design and planting species for the subject site will include Cumberland Plain Woodland trees, shrubs and understorey species of provenance to ameliorate as far as possible the loss of endemic plant species and habitat for native fauna. As the landscaped vegetation on site matures and develops over time, it will complement the restoration works that will be carried out in the riparian corridor and augment the other patches of remnant vegetation that will be retained along the northern boundary of the site and within the south-east corner of the subject site.

5.2.4 Stormwater Management

At the time of preparation of this report, Gazcorp is considering stormwater design options to manage stormwater flows on the subject site. These options are in concept design stage and will be investigated in further detail.

The key features of these design options include detention basins to collect piped and overland stormwater flows, with discharge points into Reedy Creek in the west, to an existing culvert under Wallgrove Road to the east and to a point to be determined to the north. Water quality treatment can be contained within detention areas or treated on-site in bio-retention basins within future lots.

The detention basins have potential to replace aquatic habitats for waterbirds that currently forage in the existing dams. If planted with appropriate macrophyte species, these detention basins could have potential to provide valuable habitat for native waterbirds.

5.3 Proposed Compensation Measures

As discussed above, the Project has very little opportunity to avoid the clearance of an estimated 13.1 ha of Cumberland Plain Woodland and 1.4 ha of River-flat Eucalypt Forest, both of which are both protected under the TSC Act, albeit in a highly modified and degraded form of the original vegetation communities.

To compensate for the predicted loss of the above vegetation communities, Gazcorp intend to provide a biodiversity offset that complies with the current NSW offsetting principles. A new set of offsetting principles for major projects (state significant development and state significant infrastructure) was released for NSW in July 2013. These seven principles are reproduced below:

1. *Before offsets are considered, impacts must first be avoided and unavoidable impacts minimised through mitigation measures. Only then should offsets be considered for the remaining impacts.*

2. *Offset requirements should be based on a reliable and transparent assessment of losses and gains.*

3. *Offsets must be targeted to the biodiversity values being lost or to higher conservation priorities.*

4. *Offsets must be additional to other legal requirements.*

5. *Offsets must be enduring, enforceable and auditable.*

6. *Supplementary measures can be used in lieu of offsets.*

7. *Offsets can be discounted where significant social and economic benefits accrue to NSW as a consequence of the proposal.*

A number of offsetting options were considered with respect to the above offsetting principles and are discussed below.

5.3.1 Offsetting Options

i. Land Purchase and Vegetation Management

This option comprises the acquisition of land containing a sufficient area of Cumberland Plain Woodland and River-flat Eucalypt Forest to provide a net increase in the areas of these respective communities that will be affected by the Project. This land would need to be subject to a management plan and long term management to ensure that the biodiversity values of the land improve over time.

Acquiring land as an offset can deliver good conservation outcomes because the proponent has control over where the offset will be located and the outcomes of the management of this land. This would allow the proponent to ensure that compensation measures are adequately directed to address the biodiversity loss of the development site. However, the time spent to negotiate the size and monetary value of the offset can often be lengthy.

Opportunities to purchase land for use as biodiversity offsets in Western Sydney are prohibitive and not readily available. A minimum area of 30 hectares of vegetation or land that could be returned to viable woodland would need to be sourced to satisfy at least a 2:1 offset ratio, which would likely cost millions of dollars for land purchase. Furthermore, if adequate areas of vegetation cannot be sought on a single property, offsets may then need to be split over several properties. This would be undesirable in term of good conservation principles (i.e. large patch size and connected vegetation) and would be even more costly to acquire.

In addition to this, a Biodiversity Management Plan would need to be prepared to manage and improve the biodiversity values of the land in the long term, which would further increase the costs of the offset. The landowner would need to consider whether the gain from development of the entire subject site would be capable of funding the purchase and long term management of an area of land off site. When the cost of land purchase is combined with the future costs of ongoing land management, this offsetting pathway is likely to be an unfeasible option for the Project.

ii. Donating Funds for Conservation Activities

This option comprises the donation of monetary funding to an appropriate organisation for the purpose of conservation. These funds would be used to improve and maintain other areas of Cumberland Plain Woodland and River-flat Eucalypt Forest in the locality that have better prospects for conservation.

Donating funds for the purpose of conservation provides an opportunity to maximise the potential of existing conservation programs and allows funds to be directed towards the improvement of native vegetation that have a good prospects for recovery. However, there is no established method for measuring the dollar contribution that would be required to be considered adequate compensation for a biodiversity impact. There is also no standard method for assessing the suitability of an existing program as a potential recipient of the offset funds.

It is difficult to determine whether contribution of funds to an existing conservation program will enable a particular project to achieve a net gain (or avoid a net loss) in biodiversity values in the locality of the proposed development. Under the current OEH offsetting policy offsets must be supplementary. That is, existing protected areas cannot be used to offset a project unless the contribution from the project can provide additional security or fund additional conservation actions that would result in a conservation gain (that would otherwise not be achieved under the existing program). For this reason, it could be argued that this option is generally an unsuitable approach and would not be available for the Project.

iii. Purchasing and Retiring BioBanking Biodiversity Credits

This option comprises the purchase and retirement of "biodiversity credits". Purchase and retirement of "biodiversity credits" can be carried out in accordance with a) the BioBanking scheme; or b) under the NSW OEH interim policy on assessing and offsetting biodiversity impacts (the latter is only available to Part 3A or State Significant projects).

a. BioBanking Scheme

The BioBanking scheme is a voluntary scheme that allows developments to address biodiversity impacts through the trading of "biodiversity credits". A biodiversity credit is a unit of measure of biodiversity value of a site. There are two types of biodiversity credits: "ecosystem credits" (representing native vegetation types and habitat for threatened species that can be reliably predicted in these vegetation types) and "species credits" (representing threatened species).

Biodiversity credits are lost at an impact site and generated by the improvement and maintenance of biodiversity values on someone else's land (a "Biobank" site). The biodiversity credits generated from the Biobank site are purchased by a developer and then "retired", which means that they are taken off the market and are no longer available to trade. The funds from the purchase of biodiversity credits by a developer are intended to generate an annuity that will pay for the ongoing management of the Biobank site.

The BioBanking scheme relies on the use of the BioBanking Assessment Methodology to assess the current biodiversity values of development and Biobank sites. The BioBanking Assessment Methodology provides a prescriptive method for measuring the loss of biodiversity values at a development site and conversely, the gain in biodiversity values resulting from the management of a Biobank site for biodiversity conservation (DECC, 2009). Loss and gain in credits are calculated using the BioBanking Calculator Tool, which is a web-based tool available from the OEH website.

b. Use of BioBanking for Assessing State Significant Projects

Although the BioBanking scheme is not mandatory, the BioBanking Assessment Methodology is often used to determine the size and adequacy of offsets for large development proposals being assessed under Part 3A Major Projects, Part 4 State Significant Developments (SSD) and Part 5.1 State Significant Infrastructure (SSI) of the EP&A Act.

An interim policy on assessing and offsetting biodiversity impacts of Part 3A and State Significant projects was developed by OEH and relies on the application of the BioBanking Assessment Methodology. This interim policy acknowledges that proposals assessed as State Significant projects do not have to meet the "improve or maintain" standard required under the BioBanking scheme and is consistent with Principle 7 of the NSW offsetting principles for major projects. The interim policy uses the BioBanking Assessment Methodology to quantify biodiversity values and impacts as a basis for determining a mitigated net loss outcome.

This interim policy provides an alternative to the BioBanking scheme but still involves the purchase and retirement of biodiversity credits to offset project impacts.

c. Considerations when Trading Biodiversity Credits to Offset Project Impacts

The option to offset biodiversity impacts by purchasing and retiring biodiversity credits provides a transparent process to determining appropriate offsets for a development. It is a one-off transaction that negates the need for the proponent to buy land or be involved in the ongoing management of this land.

Notwithstanding this, the current risks of the BioBanking approach to offsetting are that firstly, it relies on credits being available to purchase; and secondly, that the costs of credits are not fixed. Prices are market based and fluctuate according to demand and availability. Despite this, the condition to retire credits can still be incorporated into the Statement of Commitments to guarantee that credits are purchased and retired prior to the commencement of development on the subject site.

Of the above, the most practicable and feasible option is the purchase and retirement of BioBanking biodiversity credits, the number and type of which will be guided by using the BioBanking Assessment Methodology, the interim offsetting policy for State Significant projects and the latest NSW offsetting principles for major projects. For this reason, Gazcorp intends to seek a BioBanking offset for the Project.

5.3.2 Indicative BioBanking Assessment of the Project

A BioBanking Assessment was completed to provide an indication of the types and quantities of biodiversity credits that would likely be required by the Project. The BioBanking Assessment indicated that the following types of credits would be required for the Project:

- Shale Hills Woodland: [HN529] Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin;
- Shale Plains Woodland: [HN528] Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin;
- Alluvial Woodland: [HN526] Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin; and
- Southern Myotis (potential breeding habitat).

The indicative number of credits required for each of the above credit types are summarised in **Table 5.1** and **Table 5.2** below. The indicative credit profile generated by the BioBanking Calculator Tool is presented in **Appendix E**.

Table 5.1 Indicative Ecosystem Credit Requirement

Biometric Vegetation Type	Extent of Impact (ha)	Indicative number of credits required to offset impact
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin [HN526]	1.43	30
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin [HN528]	3.27	56
Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin [HN529]	9.85	173
ECOSYSTEM TOTAL	**14.55**	**259**

Table 5.2 Indicative Species Credit Requirement

Threatened Species	Extent of Impact (ha)	Indicative number of credits required to offset impact
Southern Myotis (potential breeding habitat)	1.43	36
SPECIES TOTAL		**295**

The BioBanking Assessment indicates that the Project will require species credits to offset impacts to a small area of potential breeding habitat for the Southern Myotis (*Myotis macropus*). The BioBanking Assessment assumes that *Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin* represents potential breeding habitat for the species. This is because Southern Myotis (*Myotis macropus*) is considered to have a particular association with riparian vegetation in proximity of dams and waterways such as the vegetation along Reedy Creek.

All other threatened species known to occur or are predicted to occur on the subject site can be reliably predicted by the vegetation communities present on site and are addressed through the acquisition of the ecosystem credits.

Biodiversity credits for all three vegetation communities are available at the time of preparation of this EIA report; however, credits for Southern Myotis (potential breeding habitat) is not yet available.

5.3.3 Proposed Offset for the Project

Although the results of the indicative BioBanking Assessment suggests that a total of 259 ecosystem credits and 295 species credits would be needed to offset the impacts of the Project, Gazcorp proposes an offset comprising 50% of the ecosystem credits indicated in the BioBanking Assessment (i.e. approximately 130 ecosystem credits). These ecosystem credits will largely comprise Cumberland Plain Woodland credit types (i.e. HN528 and HN529).

This proposed offset is considered to be appropriate for the following reasons:

- The vegetation on the subject site to be impacted by the Project exists in a highly degraded state and has poor capabilities and little opportunity for long term recovery, particularly as future development of WSEA lands around the subject site will further isolate the on-site occurrences from surrounding bushland.

- Mitigated net loss offsets that vary from the "maintain and improve" standard required under the BioBanking scheme are accepted in principle for State Significant projects.

- Of the vegetation types listed above, *Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Region* will be a key focus of the aforementioned riparian management plan and will be substantially restored on site. The restoration of the riparian habitat along Reedy Creek cannot be factored into the BioBanking Assessment as it is not proposed to register it as a Biobank site. However, the restoration work will address Project impacts on *Forest Red Gum – Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Region*.

- Although not able to be factored into the BioBanking Assessment, the restoration of vegetation along Reedy Creek will also address impacts on potential Southern Myotis (*Myotis macropus*) breeding habitat.

Chapter 6

Conclusion

The Project will have a significant impact on threatened ecological communities listed under the TSC Act. The proposal to clear 13.1 ha of the CEEC Cumberland Plain Woodland and 1.4 ha of EEC River-flat Eucalypt Forest is significant because these communities have undergone a very large reduction in their geographic distribution in a relatively short timeframe and are likely to become extinct if considerable effort is not made to conserve remaining occurrences. Notwithstanding this, it is noted that the occurrences of these communities on the subject site exist in a highly degraded state and have little opportunity for long term recovery. These occurrences are therefore unlikely to have high conservation significance in the long term.

The Project will remove low quality foraging habitat for the Southern Myotis (*Myotis macropus*), Eastern False Pipistrelle (*Falsistrellus tasmaniensis*), Greater Broad-nosed Bat (*Scoteanax rueppellii*). Square-tailed Kite (*Lophoictinia isura*) and a number of other threatened microchiropteran bat and raptor species recorded in the locality, such as Eastern Bentwing-bat (*Miniopterus shreibersii oceanensis*), Eastern Freetail-bat (*Mormopterus norfolkensis*) and Little Eagle (*Hieraaetus morphnoides*). The habitat on the subject site is unlikely to be important foraging habitat for these species and Project will not remove any known or important roosting or nesting habitat. Due to the poor quality of the foraging habitat on the subject site, the Project is unlikely to have a significant impact on threatened fauna species or their habitat.

Two bird species recorded on the subject site are listed as migratory and marine species under the EPBC Act. These species are Eastern Great Egret (*Ardea modesta*) and Cattle Egret (*Ardea ibis*). These species are expected to forage within the subject from time to time as they move around the locality. However, the subject site does not comprise important foraging or breeding habitat for these migratory species and therefore the Project is unlikely to have a significant detrimental impact on these species. No other matters of NES are likely to be present on the subject site.

The Project has potential to further degrade the riparian habitat that will be retained within the E2 zoning along Reedy Creek, or to hinder restoration efforts within the riparian corridor, during either construction or operational phases of the Project. Construction protocols and controls are recommended during the construction phase of the Project that includes pre-clearance and dam decommissioning protocols to limit inadvertent impacts to native flora and fauna that may currently be residing on the subject site.

Ongoing management and improvement activities are recommended for the riparian area of the subject site under a coordinated riparian management plan, in conjunction with the implementation of a stormwater management plan. The risks to the riparian habitat due to the Project can be sufficiently mitigated through the implementation of these recommended measures.

In recognition of the Project's predicted impacts on Cumberland Plain Woodland and River-flat Eucalypt Forest, Gazcorp intend to provide a BioBanking offset for the Project by purchasing and retiring the appropriate types and quantities of BioBanking biodiversity credits, as guided by the BioBanking Assessment Methodology, the interim offsetting policy for State Significant projects and the latest NSW offsetting principles for major projects. Suitable credits are currently available at the time of preparation of this EIA report.

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Appendix A

Assessments of Significance

Table A.1 Assessments of Significance

Assessment of Significance Criteria	Cumberland Plain Woodland	River-flat Eucalypt Forest	Square-tailed Kite	Microchiropteran Bats
a) In the case of a threatened species, whether the action proposed is likely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	Not applicable to ecological communities	Not applicable to ecological communities	The action proposed is unlikely to have an adverse effect on the life cycle of the species such that a viable local population of the species is likely to be placed at risk of extinction.	The action proposed is unlikely to have an adverse effect on the life cycle of these species such that a viable local population of each species is likely to be placed at risk of extinction.
b) In the case of an endangered population, whether the action proposed is likely to have an adverse effect on the life cycle of the species that constitutes the endangered population such that a viable local population of the species is likely to be placed at risk of extinction.	Not applicable to ecological communities	Not applicable to ecological communities	This species does not comprise an endangered population	These species do not comprise endangered populations

Table A.1 Assessments of Significance

Assessment of Significance Criteria	Cumberland Plain Woodland	River-flat Eucalypt Forest	Square-tailed Kite	Microchiropteran Bats
c) In the case of an endangered ecological community or critically endangered ecological community, whether the action proposed:			Not applicable to species or species' populations	Not applicable to species or species' populations
(i) Is likely to have an adverse effect on the extent of the ecological community such that its local occurrence is likely to be placed at risk of extinction, or	The action proposed is not likely to have an adverse effect on the extent of the ecological community such that its local occurrence (where local occurrence is taken to mean its occurrence in the broader study area) is likely to be placed at risk of extinction.	The action proposed is not likely to have an adverse effect on the extent of the ecological community such that its local occurrence (where local occurrence is taken to mean its occurrence in the broader study area) is likely to be placed at risk of extinction.	-	-
(ii) Is likely to substantially and adversely modify the composition of the ecological community such that its local occurrence is likely to be placed at risk of extinction.	The action proposed is not likely to substantially and adversely modify the composition of the ecological community such that its local occurrence (where local occurrence is taken to mean	The action proposed is not likely to substantially and adversely modify the composition of the ecological community such that its local occurrence (where local occurrence is taken to mean	-	-

Table A.1 Assessments of Significance

Assessment of Significance Criteria	Cumberland Plain Woodland	River-flat Eucalypt Forest	Square-tailed Kite	Microchiropteran Bats
	its occurrence in the broader study area) is likely to be placed at risk of extinction.	its occurrence in the broader study area) is likely to be placed at risk of extinction.		
d) In relation to the habitat of a threatened species, population or ecological community:				
(i) The extent to which habitat is likely to be removed or modified as a result of the action proposed, and	Approximately 13.1 ha of habitat will be removed for this ecological community as a result of the action proposed.	Approximately 1.4 ha of habitat will be removed for this ecological community as a result of the action proposed.	Approximately 43 ha of foraging habitat for this species will be removed as a result of the action proposed.	Approximately 14.5 ha of foraging and roosting habitat for these species will be removed as a result of the action proposed. Approximately 1.43 ha of potential breeding habitat for the Southern Myotis will be removed as a result of the action proposed.
(ii) Whether an area of habitat is likely to become fragmented or isolated from other areas of habitat as a result of the proposed action, and	The area of habitat for this ecological community is already fragmented and isolated. The action proposed is likely to increase the degree	The area of habitat for this ecological community is already fragmented and isolated. The action proposed is likely to increase the degree	The area of habitat for this species is already fragmented and isolated. As the species has a large foraging range, the action proposed is not likely to	The area of habitat for these species is already fragmented and isolated. As these species have a large foraging range, the action proposed is

Table A.1 Assessments of Significance

Assessment of Significance Criteria	Cumberland Plain Woodland	River-flat Eucalypt Forest	Square-tailed Kite	Microchiropteran Bats
	of isolation from other areas of habitat.	of isolation from other areas of habitat.	increase the degree of isolation from other areas of habitat.	not likely to increase the degree of isolation from other areas of habitat.
(iii) The importance of the habitat to be removed, modified, fragmented or isolated to the long-term survival of the species, population or ecological community in the locality.	This ecological community has undergone a large reduction in its geographic distribution in a relatively short timeframe and now occurs largely as scattered remnant patches. The habitat to be removed is likely to be important to the long term survival of the ecological community. However, due to its current condition, its long term viability in the absence of the action proposed is not high.	This ecological community has undergone a large reduction in its geographic distribution in a relatively short timeframe and now occurs largely as scattered remnant patches. The habitat to be removed is likely to be important to the long term survival of the ecological community. However, due to its current condition, its long term viability in the absence of the action proposed is not high.	The habitat to be removed by the action proposed provides very low quality habitat for this species and is not important to the long term survival of the species.	The habitat to be removed by the action proposed provides very low quality habitat for these species and is not important to the long term survival of the species.
e) Whether the action proposed is likely to have an adverse effect on critical habitat (either directly or indirectly).	No critical habitat for this ecological community has been declared.	No critical habitat for this ecological community has been declared.	No critical habitat for this species has been declared.	No critical habitat for these species have been declared.

Table A.1 Assessments of Significance

Assessment of Significance Criteria	Cumberland Plain Woodland	River-flat Eucalypt Forest	Square-tailed Kite	Microchiropteran Bats
f) Whether the action proposed is consistent with the objectives or actions of a recovery plan or threat abatement plan.	The action proposed is not consistent with the objectives of the Cumberland Plain Recovery Plan.	The action proposed is not consistent with the objectives of the Cumberland Plain Recovery Plan.	The action proposed includes riparian restoration, which is consistent with one priority action for the species: "Ensure implementation of management strategies that reduce disturbance of riparian areas". The removal of habitat in other areas of the site is inconsistent with the priority actions.	The action proposed is not consistent with the objectives of the Action Plan for Australian Bats.
g) Whether the action proposed constitutes or is part of a key threatening process or is likely to result in the operation of, or increase the impact of, a key threatening process.	The action proposed constitutes the following key threatening processes: "clearing of native vegetation", "loss of hollow bearing trees" and "removal of dead wood and dead trees". The action proposed has potential to increase the impact of the following key threatening processes: "predation by feral cats" and "predation by the	The action proposed constitutes the following key threatening processes: "clearing of native vegetation", "loss of hollow bearing trees" and "removal of dead wood and dead trees". The action proposed has potential to increase the impact of the following key threatening processes: "predation by feral cats" and "predation by the	The action proposed constitutes the following key threatening processes: "clearing of native vegetation", "loss of hollow bearing trees" and "removal of dead wood and dead trees". The action proposed has potential to increase the impact of the following key threatening processes: "predation by feral cats" and "predation by the	The action proposed constitutes the following key threatening processes: "clearing of native vegetation", "loss of hollow bearing trees" and "removal of dead wood and dead trees". The action proposed has potential to increase the impact of the following key threatening processes: "predation by feral cats" and "predation by the

Table A.1 Assessments of Significance

Assessment of Significance Criteria	Cumberland Plain Woodland	River-flat Eucalypt Forest	Square-tailed Kite	Microchiropteran Bats
	European red fox".	European red fox".	European red fox".	European red fox".
Conclusion	The occurrence of this ecological community on the subject site represents highly degraded examples the community and does not have a high long term viability without active management. Notwithstanding, this community has been listed as threatened because it has undergone a very large reduction in its geographic distribution in a relatively short timeframe and is likely to become extinct if considerable effort is not made to conserve remaining occurrences. Without offsetting measures, the Project is likely to have a significant impact on the ecological community.	The occurrence of this ecological community on the subject site represents highly degraded examples the community and does not have a high long term viability without active management. Notwithstanding, this community has been listed as threatened because it has undergone a very large reduction in its geographic distribution in a relatively short timeframe and is likely to become extinct if considerable effort is not made to conserve remaining occurrences. Without offsetting measures, the Project is likely to have a significant impact on the ecological community.	The action proposed will remove a relatively small area of foraging habitat that comprises a small proportion of the species' foraging range. Better quality foraging, roosting and nesting habitat will remain for these species in the locality of the subject site in bushland around Prospect Reservoir, in Kemps Creek Nature Reserve and in the Western Sydney Regional Park. Therefore, the Project is unlikely to have a significant impact on this species.	The action proposed will remove a relatively small area of foraging and potential roosting habitat that comprises a small proportion of the species' distributional range. Better quality foraging and roosting habitat will remain for these species in the locality of the subject site in bushland around Prospect Reservoir, in Kemps Creek Nature Reserve and in the Western Sydney Regional Park. Therefore, the Project is unlikely to have a significant impact on these species.

Appendix B

Field Data

B.1 Quadrat Data

The tables below contain floristic and structural data collected from 10 quadrat sample plots across the subject site. Floristic data were collected from 20 m x 20 m plots and the frequency-abundance scores estimated for each species occurring in each vegetation stratum (**Table B.1**) Within the 20 m x 20 m plots, the height, percentage foliage cover and percentage cover of weed species were estimated across each stratum (**Table B.2**).

Each quadrat sample plot was then extended to 20 m x 50 m in order to collect additional habitat and vegetation structural data in accordance with the biometric sampling methods prescribed in DECC (2008). This data is presented in **Table B.3**.

Table B.1 Floristic Data Collected from 20 m x 20 m Quadrat Samples

Stratum	Family	Species	Common Name	Status	Frequency-Abundance Scores*									
					Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
trees	Casuarinaceae	*Casuarina glauca*	Swamp Oak	native				4		6				
trees	Myrtaceae	*Eucalyptus moluccana*	Grey Box	native							5		6	5
trees	Myrtaceae	*Eucalyptus tereticornis*	Forest Red Gum	native				5	5		6			6
trees	Myrtaceae	*Eucalytus amplifolia*	Cabbage Gum	native				5	5					
trees	Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree	native						5				
small trees	Myrtaceae	*Melaleuca styphelioides*	Prickly-leaved Tea Tree	native				2						
shrubs	Asteraceae	*Senecio pterophorus?*	African Daisy	exotic										1
shrubs	Fabaceae-Mimosoideae	*Acacia parramattensis*	Parramatta Wattle	native				2						
shrubs	Malvaceae	*Sida rhombifolia*	Paddy's Lucerne	exotic	3	2	2	4	6	3	5	4	4	5
shrubs	Phytolaccaceae	*Phytolacca octandra*	Inkweed	exotic									1	
shrubs	Pittosporaceae	*Bursaria spinosa*	Blackthorn	native					2					3
shrubs	Polygonaceae	*Persicaria sp.*	a Knotweed	native					1					
shrubs	Solanaceae	*Lycium ferocissimum*	African Boxthorn	exotic				3		6	2		2	
shrubs	Solanaceae	*Solanum pseudocapsicum*	Jerusalem Cherry	exotic										1
shrubs	Solanaceae	*Solanum sisymbriifolium*	Sticky Nightshade	exotic		1		3	1		1		4	
shrubs	Verbenaceae	*Lantana camara*	Lantana	exotic					2					
herbs-dicots	Asteraceae	*Cirsium vulgare*	Spear Thistle	exotic		1		2			2	2		2
herbs-dicots	Asteraceae	*Conyza bonariensis*	Common Fleabane	exotic				2				2		

Table B.1 Floristic Data Collected from 20 m x 20 m Quadrat Samples

Stratum	Family	Species	Common Name	Status	Frequency-Abundance Scores*									
					Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
herbs-dicots	Asteraceae	*Euchiton sp.*	a Cudweed	native	2									
herbs-dicots	Asteraceae	*Gamochaeta sp.*	a Cudweed	exotic			3							
herbs-dicots	Asteraceae	*Lactuca serriola*	Prickly Lettuce	exotic				1						
herbs-dicots	Asteraceae	*Leontodon taraxacoides ssp. taraxacoides*	Lesser Hawkbit	exotic			2							
herbs-dicots	Asteraceae	*Senecio madagascariensis*	Fireweed	exotic	2		2	1			2	4		
herbs-dicots	Brassicaceae	*Lepidium bonariense*	-	exotic				1					2	
herbs-dicots	Chenopodiaceae	*Einadia hastata*	Berry Saltbush	native				4	2		2		2	
herbs-dicots	Chenopodiaceae	*Einadia nutans*	Climbing Saltbush	native									2	
herbs-dicots	Gentianaceae	*Centaurium erythraea*	Common Centaury	exotic			2							
herbs-dicots	Plantaginaceae	*Plantago lanceolata*	Lamb's Tongue	exotic			2	3			2			2
herbs-dicots	Polygonaceae	*Rumex bidens*	Mud Dock	native				2						
herbs-dicots	Portulaceae	*Portulaca oleracea*	Pigweed	exotic									1	
herbs-dicots	Solanaceae	*Solanum nigrum*	Black-berry Nightshade	exotic				2	1					
herbs-dicots	Verbenaceae	*Verbena bonariensis*	Verbena	exotic	1	3				2	2	2		
herbs-monocots	Cyperaceae	*Carex inversa*	-	native		2					1	2		
herbs-monocots	Cyperaceae	*Cyperus eragrostis?*	-	exotic				1						
herbs-monocots	Linaceae	*Linum trigynum*	French Flax	exotic	1									
herbs-monocots	Poaceae	*Axonopus fissifolius (syn. A.*	Narrow-leafed Carpet	exotic	2									

Table B.1 Floristic Data Collected from 20 m x 20 m Quadrat Samples

Stratum	Family	Species	Common Name	Status	Frequency-Abundance Scores*									
					Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
		affinis)	Grass											
herbs-monocots	Poaceae	*Briza subaristata*	-	exotic							2	4		
herbs-monocots	Poaceae	*Bromus catharticus*	Prairie Grass	exotic	2	3		2	2	4	3	3		
herbs-monocots	Poaceae	*Chloris gayana*	Rhodes Grass	exotic						3				
herbs-monocots	Poaceae	*Cynodon dactylon*	Couch Grass	cultivated	7	5	7		3	2	5	4	6	4
herbs-monocots	Poaceae	*Dichelachne crinita*	Longhair Plumegrass	native			1							
herbs-monocots	Poaceae	*Ehrharta erecta*	Panic Veldtgrass	exotic				2	3	4			2	
herbs-monocots	Poaceae	*Eragrostis leptostachya*	Paddock Lovegrass	native									2	2
herbs-monocots	Poaceae	*Lachnagrostis filiformis*	-	native	2	2			1				1	
herbs-monocots	Poaceae	*Microlaena stipoides*	Weeping Meadowgrass	native				2			2		2	
herbs-monocots	Poaceae	*Paspalum dilatatum*	Paspalum	exotic	4			3	2	3	5	6		3
herbs-monocots	Poaceae	*Pennisetum clandestinum*	Kikuyu	exotic		6	5	5				6		
herbs-monocots	Poaceae	*Rytidosperma fulvum syn. Austrodanthonia fulva*	Wallaby Grass	native									1	
herbs-monocots	Poaceae	*Setaria parviflora*	-	exotic										2
herbs-creepers	Apocynaceae	*Araujia sericifera*	Moth Vine	exotic				3		3				
herbs-creepers	Caprifoliaceae	*Lonicera japonica*	Japanese Honeysuckle	exotic						3				
herbs-creepers	Commelinaceae	*Commelina cyanea*	Native Wandering Jew	native						3				
herbs-creepers	Commelinaceae	*Tradescantia fluminensis*	Wandering Jew	exotic				6		6				

Table B.1 Floristic Data Collected from 20 m x 20 m Quadrat Samples

Stratum	Family	Species	Common Name	Status	Frequency-Abundance Scores*									
					Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
herbs-creepers	Fabaceae-Faboideae	*Glycine tabacina*	-	native							2		2	2

For definitions of the frequency-abundance scores, see **Table 2.4.*

Table B.2 Structural Data Estimated in 20 m x 20 m Quadrat Samples

Attributes / *Stratum*	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Height (m)										
Tree	0	0	0	20	15	25	12	0	15	15
Sml Tree	0	0	0	4	0	0	0	0	0	0
Shrub	0.3	1	0.3	1-3	1-2	1-3	1	0	1	1-1.5
Ground	0.1	0.2	0.1	0.2-0.5	0.3	0.5	0.2	0.4	0.25	0.05
Percentage Foliage Cover (%)										
Tree	0	0	0	40	30	25	25	0	25	30
Sml Tree	0	0	0	<5	0	0	0	0	0	0
Shrub	<5	<5	<5	20	20	30	10	0	10	30
Ground	75	80	75	75	70	60	75	90	75	30
Bare	5	0	5	5	1-2	5	5	0	10	10
Litter	20	20	20	20	30	30	20	10	15	60

Table B.2 Structural Data Estimated in 20 m x 20 m Quadrat Samples

Attributes / *Stratum*	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
Rock	0	0	0	0	0	0	0	0	0	0
Moss	0	0	0	0	0	0	0	0	0	0
Percentage Cover of Weeds (%)										
Tree	0	0	0	0	0	0	0	0	0	0
Sml Tree	0	0	0	0	0	0	0	0	0	0
Shrub	100	50	100	90	100	50	100	0	100	90
Ground	100	>95	>95	95	>90	>95	>90	>95	>90	>90

Table B.3 Biometric Data Collected from 20 m x 50 m Quadrat Samples

Sample ID	NOS (%)	NMS (%)	EPC (%)	NGCg (%)	NGCs (%)	NGCo (%)	NTH (%)	NH/T	OR (%)	FL (m)
Q1	0	0	29.3	0	0	0	0	0	0	0
Q2	0	0	29.3	0	0	0	0	0	0	0
Q3	0	0	22.0	0	0	0	0	0	0	0
Q4	22.5	0	15.5	0	4	4	1	1	66	25
Q5	18.5	0	18.0	2	0	0	0	0	50	23
Q6	18.5	0	21.0	0	0	0	0	0	66	12.5
Q7	4	0	18.7	0	0	2	0	0	50	0.5
Q8	0	0	28.0	0	0	0	0	0	0	0
Q9	14.5	0	18.0	0	0	0	1	14	100	4.5
Q10	11.5	0	13.3	0	0	6	0	0	100	6

Key:

NOS (%)	*Native Over-storey*
NMS (%)	*Native Mid-storey*
EPC (%)	*Exotics (estimated as average across tree, mid-storey and ground strata)*
NGCg (%)	*Native Groundcover (native grasses)*
NGCs (%)	*Native Groundcover (native shrubs)*
NGCo (%)	*Native Groundcover (other natives)*
NTH (%)	*Number of trees with hollows*
NH/T	*Number of hollows per tree*
OR (%)	*Proportion of canopy species regenerating across the entire vegetation community*
FL (m)	*Length of fallen logs*

B.2 Biometric Condition Assessment

Low condition vegetation is defined by DECC (2008) as:

1. Woody native vegetation with native over-storey percent foliage cover less than 25% of the lower value of the over-storey percent foliage cover benchmark for that vegetation type, **and**:
    - Less than 50% of ground cover vegetation is indigenous species, or
    - Greater than 90% of ground cover vegetation is cleared.
2. Native grassland, wetland or herbfield where:
    - Less than 50% of ground cover vegetation is indigenous species, or
    - More than 90% of ground cover vegetation is cleared.

Considering the above definition, for woody vegetation occurring on the subject site the average over-storey percent foliage cover was compared to benchmark values (OEH, 2008) in the first instance. For grassland areas, the average percent foliage cover of native ground species was compared to the 50% threshold value. The results are summarised in **Table B.4** below.

Table B.4 Results of Biometric Assessment of Vegetation Condition on the Subject Site

Vegetation Community	*BVT	Overstorey Percent Foliage Cover (PFC)				% native ground cover	% native ground cover >50%	Condition
		^lower benchmark	25% of lower benchmark	average PFC (subject site)	av. PFC < 25% of lower benchmark			
Alluvial Woodland	HN526	27.5	6.9	20.5	no	5	no	Moderate to good
Shale Plains Woodland	HN528	20.5	5.1	11.25	no	10	no	Moderate to good
Shale Hills Woodland	HN529	18.5	4.6	13	no	10	no	Moderate to good
Grassland	na	na	na	na	na	3.75	no	Low

**BVT = BioBanking Vegetation Type (OEH, 2012e)*

PFC = percent foliage cover

^From Vegetation Types Database (OEH, 2008)

B.3 Flora and Fauna Species Lists

Table B.5 Flora Species Recorded from the Subject Site

Form	Family	Status	*Weed Status	Scientific Name	Common Name
trees	Casuarinaceae	native		*Casuarina glauca*	Swamp Oak
trees	Myrtaceae	native		*Eucalyptus amplifolia*	Cabbage Gum
trees	Myrtaceae	native		*Eucalyptus moluccana*	Grey Box
trees	Myrtaceae	native		*Eucalyptus piperita subsp. piperita*	Sydney Peppermint
trees	Myrtaceae	native		*Eucalyptus tereticornis*	Forest Red Gum
small tree	Myrtaceae	native		*Melaleuca decora*	-
small tree	Myrtaceae	native		*Melaleuca linariifolia*	Snow in Summer
small tree	Myrtaceae	native		*Melaleuca styphelioides*	Prickly-leaved Tea Tree
shrubs	Asteraceae	exotic	WONS; Class 2 weed	*Chrysanthemoides monilifera subsp. monilifera*	Boneseed
shrubs	Asteraceae	exotic		*Senecio pterophorus?*	African Daisy
shrubs	Euphorbiaceae	exotic		*Ricinus communis*	Castor Oil Plant
shrubs	Fabaceae-Caesalpinioideae	exotic		*Senna pendula var. glabrata*	-
shrubs	Fabaceae-Mimosoideae	native		*Acacia decurrens*	Black Wattle
shrubs	Fabaceae-Mimosoideae	native		*Acacia parramattensis*	Parramatta Wattle
shrubs	Malvaceae	exotic		*Sida rhombifolia*	Paddy's Lucerne
shrubs	Oleaceae	exotic	Class 4 weed	*Ligustrum lucidum*	Large-leaved Privet
shrubs	Oleaceae	exotic	Class 4 weed	*Ligustrum sinense*	Small-leaved Privet

Table B.5 Flora Species Recorded from the Subject Site

Form	Family	Status	*Weed Status	Scientific Name	Common Name
shrubs	Oleaceae	exotic		*Oleo europea ssp. cuspidata*	African Olive
shrubs	Phytolaccaceae	exotic		*Phytolacca octandra*	Inkweed
shrubs	Pittosporaceae	native		*Bursaria spinosa var. spinosa*	Blackthorn
shrubs	Rubiaceae	native		*Opercularia diphylla*	-
shrubs	Solanaceae	exotic	Class 3 weed	*Cestrum parqui*	Chilean Cestrum
shrubs	Solanaceae	exotic	WONS	*Lycium ferocissimum*	African Boxthorn
shrubs	Solanaceae	exotic		*Solanum mauritianum*	Wild Tobacco
shrubs	Solanaceae	exotic		*Solanum pseudocapsicum*	Jerusalem Cherry
shrubs	Solanaceae	exotic		*Solanum sisymbriifolium*	Sticky Nightshade
shrubs	Verbenaceae	exotic	WONS; Class 4 weed	*Lantana camara*	Lantana
herbs-dicots	Acanthaceae	native		*Brunoniella australis*	Blue Trumpet
herbs-dicots	Asteraceae	exotic		*Bidens pilosa*	Cobbler's Pegs
herbs-dicots	Asteraceae	native		*Brachycome multifida var. multifida*	Cut-leaved Daisy
herbs-dicots	Asteraceae	exotic		*Cirsium vulgare*	Spear Thistle
herbs-dicots	Asteraceae	exotic		*Conyza bonariensis*	Common Fleabane
herbs-dicots	Asteraceae	native		*Euchiton involucratus*	Star Cudweed
herbs-dicots	Asteraceae	native		*Euchiton sp.*	a Cudweed
herbs-dicots	Asteraceae	exotic		*Gamochaeta sp.*	a Cudweed
herbs-dicots	Asteraceae	exotic		*Lactuca serriola*	Prickly Lettuce
herbs-dicots	Asteraceae	exotic		*Leontodon taraxacoides ssp. taraxacoides*	Lesser Hawkbit

Table B.5 Flora Species Recorded from the Subject Site

Form	Family	Status	*Weed Status	Scientific Name	Common Name
herbs-dicots	Asteraceae	exotic	WONS	*Senecio madagascariensis*	Fireweed
herbs-dicots	Brassicaceae	exotic		*Lepidium bonariense*	-
herbs-dicots	Brassicaceae	native		*Rorippa laciniata*	-
herbs-dicots	Cactaceae	exotic	WONS; Class 4 weed	*Opuntia stricta*	Prickly Pear
herbs-dicots	Campanulaceae	native		*Wahlenbergia gracilis*	Australian Bluebell
herbs-dicots	Chenopodiaceae	native		*Einadia hastata*	Berry Saltbush
herbs-dicots	Chenopodiaceae	native		*Einadia nutans subsp. linifolia*	Climbing Saltbush
herbs-dicots	Chenopodiaceae	native		*Einadia polygonoides*	-
herbs-dicots	Chenopodiaceae	native		*Einadia trigonos subsp. trigonos*	Fishweed
herbs-dicots	Convolvulaceae	native		*Dichondra repens*	Kidney Weed
herbs-dicots	Gentianaceae	exotic		*Centaurium erythraea*	Common Centaury
herbs-dicots	Goodeniaceae	native		*Goodenia hederacea subsp. hederacea*	Ivy-leaved Goodenia
herbs-dicots	Goodeniaceae	native		*Goodenia heterophylla subsp. heterophylla*	Variable Leaved Goodenia
herbs-dicots	Lamiaceae	native		*Plectranthus sp.*	-
herbs-dicots	Lobeliaceae	native		*Pratia purpurascens*	Whiteroot
herbs-dicots	Oxalidaceae	native		*Oxalis perrenans*	-
herbs-dicots	Plantaginaceae	exotic		*Plantago lanceolata*	Lamb's Tongue
herbs-dicots	Polygonaceae	native		*Persicaria sp.*	a Knotweed
herbs-dicots	Polygonaceae	native		*Persicaria subsessilis*	-
herbs-dicots	Polygonaceae	native		*Rumex bidens*	Mud Dock

Table B.5 Flora Species Recorded from the Subject Site

Form	Family	Status	*Weed Status	Scientific Name	Common Name
herbs-dicots	Portulaceae	exotic		*Portulaca oleracea*	Pigweed
herbs-dicots	Ranunculaceae	native		*Ranunculus plebeius*	Hairy Buttercup
herbs-dicots	Solanaceae	native		*Solanum aviculare*	Kangaroo Apple
herbs-dicots	Solanaceae	exotic		*Solanum nigrum*	Black-berry Nightshade
herbs-dicots	Solanaceae	native		*Solanum prinophyllum*	Forest Nightshade
herbs-dicots	Verbenaceae	exotic		*Verbena bonariensis*	Verbena
herbs-monocots	Asparagaceae	exotic	WONS	*Asparagus aethiopicus*	Asparagus Fern
herbs-monocots	Asparagaceae	exotic		*Asparagus officinalis*	Asparagus
herbs-monocots	Cyperaceae	native		*Carex inversa*	-
herbs-monocots	Cyperaceae	exotic		*Cyperus congestus*	-
herbs-monocots	Cyperaceae	exotic		*Cyperus eragrostis?*	-
herbs-monocots	Cyperaceae	native		*Eleocharis sphacelata*	-
herbs-monocots	Linaceae	exotic		*Linum trigynum*	French Flax
herbs-monocots	Poaceae	native		*Aristida vagans*	Three-awn Speargrass
herbs-monocots	Poaceae	exotic		*Axonopus fissifolius (syn. A. affinis)*	Narrow-leafed Carpet Grass
herbs-monocots	Poaceae	exotic		*Briza subaristata*	-
herbs-monocots	Poaceae	exotic		*Bromus catharticus*	Prairie Grass
herbs-monocots	Poaceae	exotic		*Chloris gayana*	Rhodes Grass
herbs-monocots	Poaceae	native		*Cymbopogon refractus*	Barbwire Grass
herbs-monocots	Poaceae	exotic		*Cynodon dactylon (naturalised, cultivated)*	Couch Grass

Table B.5 Flora Species Recorded from the Subject Site

Form	Family	Status	*Weed Status	Scientific Name	Common Name
herbs-monocots	Poaceae	native		*Dichelachne crinita*	Longhair Plumegrass
herbs-monocots	Poaceae	native		*Dichelachne micrantha*	Short-hair Plume Grass
herbs-monocots	Poaceae	exotic		*Ehrharta erecta*	Panic Veldtgrass
herbs-monocots	Poaceae	native		*Entolasia stricta*	Wiry Panic
herbs-monocots	Poaceae	native		*Eragrostis leptostachya*	Paddock Lovegrass
herbs-monocots	Poaceae	native		*Lachnagrostis filiformis*	-
herbs-monocots	Poaceae	native		*Microlaena stipoides var. stipoides*	Weeping Meadowgrass
herbs-monocots	Poaceae	native		*Oplismenus imbecillis*	-
herbs-monocots	Poaceae	native		*Paspalidium distans*	-
herbs-monocots	Poaceae	exotic		*Paspalum dilatatum*	Paspalum
herbs-monocots	Poaceae	native		*Paspalum distichum*	Water Couch
herbs-monocots	Poaceae	exotic		*Paspalum urvillei*	Vasey Grass
herbs-monocots	Poaceae	exotic		*Pennisetum clandestinum*	Kikuyu
herbs-monocots	Poaceae	native		*Rytidosperma fulvum (syn. Austrodanthonia fulva)*	Wallaby Grass
herbs-monocots	Poaceae	exotic		*Setaria parviflora*	-
herbs-monocots	Poaceae	exotic		*Setaria verticilliata*	Whorled Pigeon Grass
herbs-monocots	Poaceae	native		*Themeda australis*	Kangaroo Grass
herbs-creepers	Apocynaceae	exotic		*Araujia sericifera*	Moth Vine
herbs-creepers	Asparagaceae	exotic	WONS; Class 4 weed	*Asparagus asparagoides*	Bridal Creeper
herbs-creepers	Caprifoliaceae	exotic		*Lonicera japonica*	Japanese Honeysuckle

Table B.5 Flora Species Recorded from the Subject Site

Form	Family	Status	*Weed Status	Scientific Name	Common Name
herbs-creepers	Commelinaceae	native		*Commelina cyanea*	Native Wandering Jew
herbs-creepers	Commelinaceae	exotic		*Tradescantia fluminensis*	Wandering Jew
herbs-creepers	Fabaceae-Faboideae	native		*Glycine clandestina*	Twining Glycine
herbs-creepers	Fabaceae-Faboideae	native		*Glycine microphylla*	-
herbs-creepers	Fabaceae-Faboideae	native		*Glycine tabacina*	Twining Glycine

**WONS = Weed of National Significance; weed class applies to noxious weeds listed under the Noxious Weeds Act 1993 for Fairfield Local Government Area*

Table B.6 Fauna Species Recorded from the Subject Site

Class	Order	Family	Scientific Name	Common Name	EPBC Act	TSC Act	Introduced	2008			2012-2013		
								Gr	WetId	WdInd	Gr	WetId	WdInd
GASTROPODA	-	Helicidae	*Helix aspersa*	Brown Garden Snail			*			x			
AMPHIBIA	ANURA	Hylidae	*Litoria caerulea*	Green Tree Frog								x	
AMPHIBIA	ANURA	Hylidae	*Litoria peronii*	Peron's Tree Frog						x			
AMPHIBIA	ANURA	Hylidae	*Litoria verreauxii verreauxii*	Whistling Tree Frog						x			
AMPHIBIA	ANURA	Limnodynastidae	*Limnodynastes peronii*	Striped Marsh Frog				x		x			

Table B.6 Fauna Species Recorded from the Subject Site

Class	Order	Family	Scientific Name	Common Name	EPBC Act	TSC Act	Introduced	2008			2012-2013		
								Gr	WetId	WdInd	Gr	WetId	WdInd
AMPHIBIA	ANURA	Limnodynastidae	*Limnodynastes tasmaniensis*	Spotted Marsh Frog				x		x			
AMPHIBIA	ANURA	Myobatrachidae	*Crinia signifera*	Common Froglet				x		x			
REPTILIA	SQUAMATA	Scincidae	*Lampropholis guichenoti*	Common Garden Skink				x		x			
AVES	ANSERIFORMES	Anatidae	*Cygnus atratus*	Black Swan				x		x			
AVES	ANSERIFORMES	Anatidae	*Chenonetta jubata*	Australian Wood Duck					x			x	x
AVES	ANSERIFORMES	Anatidae	*Anas castanea*	Cheatnut Teal					x				
AVES	ANSERIFORMES	Anatidae	*Anas gracilis*	Grey Teal					x	x		x	
AVES	ANSERIFORMES	Anatidae	*Anas superciliosa*	Pacific Black Duck								x	
AVES	COLUMBIFORMES	Columbidae	*Ocyphaps lophotes*	Crested Pigeon						x			x
AVES	COLUMBIFORMES	Columbidae	*Geopelia humeralis*	Bar-shouldered Dove						x			
AVES	PHALACROCORACIFORMES	Phalacrocoracidae	*Phalacrocorax sulcirostris*	Little Black Cormorant								x	
AVES	CICONIIFORMES	Ardeidae	*Ardea pacifica*	White-necked Heron								x	
AVES	CICONIIFORMES	Ardeidae	*Ardea modesta*	Eastern Great Egret	M							x	
AVES	CICONIIFORMES	Ardeidae	*Ardea ibis*	Cattle Egret	M						x		
AVES	CICONIIFORMES	Ardeidae	*Egretta*	White-faced Heron				x					

Table B.6 Fauna Species Recorded from the Subject Site

Class	Order	Family	Scientific Name	Common Name	EPBC Act	TSC Act	Introduced	2008			2012-2013		
								Gr	WetId	WdInd	Gr	WetId	WdInd
			novaehollandiae										
AVES	CICONIIFORMES	Threskiornithidae	*Threskiornis molucca*	Australian White Ibis				x			x	x	
AVES	CICONIIFORMES	Threskiornithidae	*Threskiornis spinicollis*	Straw-necked Ibis				x				x	
AVES	ACCIPITRIFORMES	Accipitridae	*Lophoictinia isura*	Square-tailed Kite		V				x			
AVES	GRUIFORMES	Rallidae	*Porphyrio porphyrio*	Purple Swamphen								x	
AVES	GRUIFORMES	Rallidae	*Fulica atra*	Eurasian Coot								x	
AVES	CHARADRIIFORMES	Recurvirostridae	*Himantopus himantopus*	Black-winged Stilt				x		x			
AVES	PSITTACIFORMES	Cacatuidae	*Eolophus roseicapillus*	Galah						x			
AVES	PSITTACIFORMES	Cacatuidae	*Cacatua galerita*	Sulfur-crested Cockatoo						x			
AVES	PSITTACIFORMES	Psittacidae	*Trichoglossus haematodus*	Rainbow Lorikeet				x		x			
AVES	PSITTACIFORMES	Psittacidae	*Platycercus eximius*	Eastern Rosella				x		x			x
AVES	CORACIIFORMES	Halcyonidae	*Dacelo novaeguineae*	Laughing Kookaburra				x		x			x

Table B.6 Fauna Species Recorded from the Subject Site

Class	Order	Family	Scientific Name	Common Name	EPBC Act	TSC Act	Introduced	2008			2012-2013		
								Gr	WetId	WdInd	Gr	WetId	WdInd
AVES	PASSERIFORMES	Maluridae	*Malurus cyaneus*	Superb Fairy-wren									x
AVES	PASSERIFORMES	Maluridae	*Malurus lamberti*	Varigated Fairy-wren						x			
AVES	PASSERIFORMES	Acanthizidae	*Smicrornis brevirostris*	Weebill				x					
AVES	PASSERIFORMES	Acanthizidae	*Acanthiza chrysorrhoa*	Yellow-rumped Thornbill									x
AVES	PASSERIFORMES	Meliphagidae	*Manorina melanocephala*	Noisy Miner				x		x			x
AVES	PASSERIFORMES	Meliphagidae	*Anthochaera carunculata*	Red Wattlebird									x
AVES	PASSERIFORMES	Dicruridae	*Grallina cyanoleuca*	Magpie-lark				x		x			x
AVES	PASSERIFORMES	Campephagidae	*Coracina novaehollandiae*	Black-faced Cuckoo-shrike									x
AVES	PASSERIFORMES	Artamidae	*Cracticus nigrogularis*	Pied Butcherbird				x		x			
AVES	PASSERIFORMES	Artamidae	*Cracticus tibicen*	Australian Magpie						x			x
AVES	PASSERIFORMES	Artamidae	*Strepera graculina*	Pied Currawong				x		x			
AVES	PASSERIFORMES	Rhipiduridae	*Rhipidura albiscapa*	Grey Fantail				x		x			

Table B.6 Fauna Species Recorded from the Subject Site

Class	Order	Family	Scientific Name	Common Name	EPBC Act	TSC Act	Introduced	2008			2012-2013		
								Gr	WetId	WdInd	Gr	WetId	WdInd
AVES	PASSERIFORMES	Rhipiduridae	*Rhipidura leucophrys*	Willie Wagtail				x					x
AVES	PASSERIFORMES	Corvidae	*Corvus coronoides*	Australian Raven				x	x	x			x
AVES	PASSERIFORMES	Corvidae	*Corvus mellori*	Little Raven				x		x			
AVES	PASSERIFORMES	Hirundinidae	*Hirundo neoxena*	Welcome Swallow				x		x	x		
AVES	PASSERIFORMES	Sturnidae	*Sturnus tristis*	Common Myna			*	x		x			x
MAMMALIA	DIPROTODONTIA	Phalangeridae	*Trichosurus vulpecula*	Common Brushtail Possum						x			
MAMMALIA	CHIROPTERA	Molossidae	*Mormopterus ridei (formerly "species 2")*	Eastern Freetail-bat								x	x
MAMMALIA	CHIROPTERA	Vespertilionidae	*Chalinolobus gouldii*	Gould's Wattled Bat								x	x
MAMMALIA	CHIROPTERA	Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle		V						x	x
MAMMALIA	CHIROPTERA	Vespertilionidae	*Myotis macropus*	Large-footed Myotis		V						x	x
MAMMALIA	CHIROPTERA	Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat		V						x	x
MAMMALIA	CHIROPTERA	Vespertilionidae	*Scotorepens orion*	Eastern Broad-nosed Bat								x	x

Table B.6 Fauna Species Recorded from the Subject Site

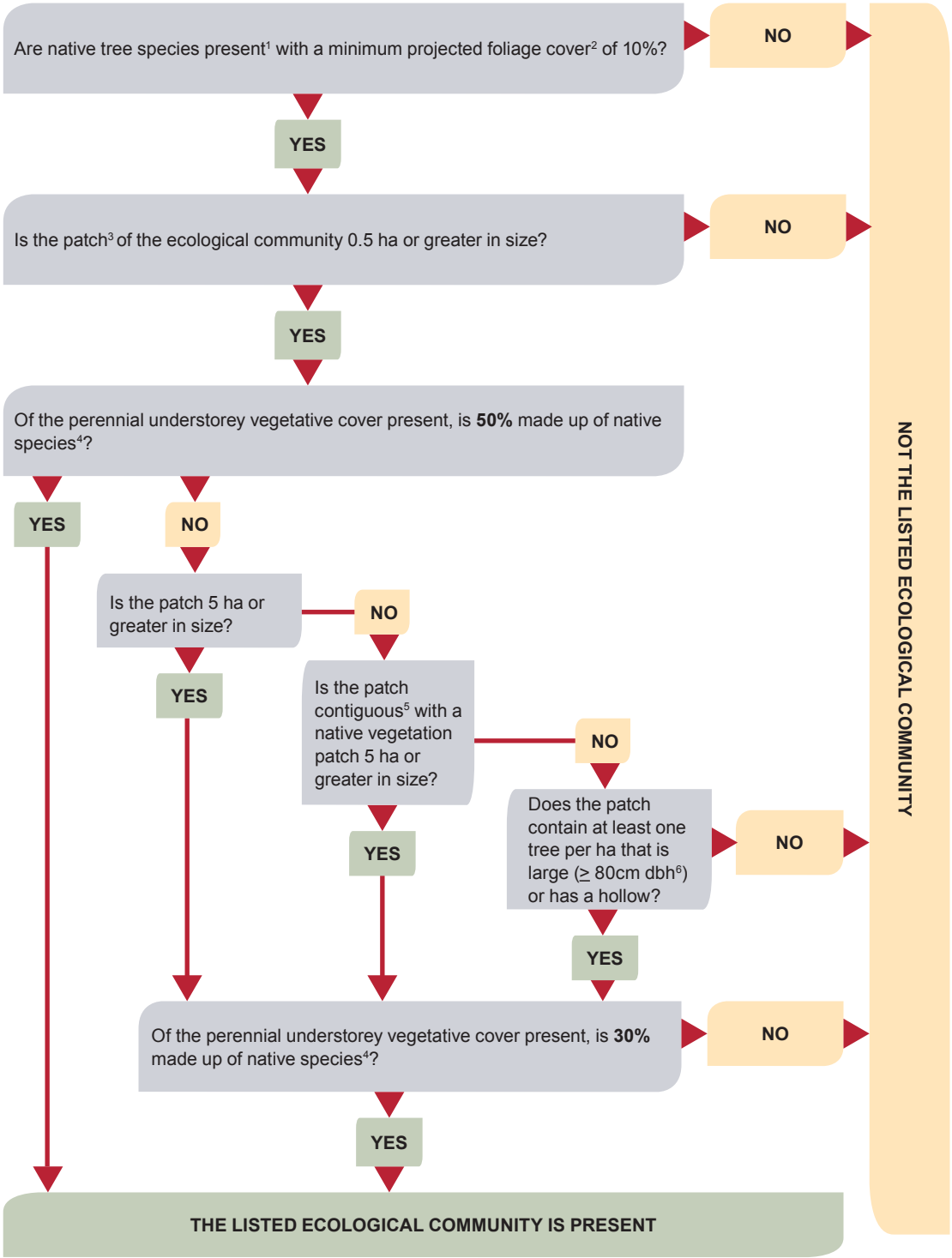
Class	Order	Family	Scientific Name	Common Name	EPBC Act	TSC Act	Introduced	2008			2012-2013		
								Gr	WetId	WdInd	Gr	WetId	WdInd
MAMMALIA	RODENTIA	Muridae	*Rattus rattus*	Black Rat			*					x	x
MAMMALIA	CARNIVORA	Canidae	*Vulpes vulpes*	Red Fox			*	x			x		x
MAMMALIA	ARTIODACTYLA	Bovidae	*Bos taurus*	Cattle			*						x
MAMMALIA	ARTIODACTYLA	Bovidae	*Capra hircus*	Goat			*				x		x
MAMMALIA	PERISSODACTYLA	Equidae	*Equus ferus caballus*	Horse			*				x		x
MAMMALIA	LAGOMORPHA	Leporidae	*Lepus capensis*	Brown Hare			*	x		x			
MAMMALIA	LAGOMORPHA	Leporidae	*Oryctolagus cuniculus*	European Rabbit			*	x		x	x		

Gr = grassland; WetId = wetland; WdInd = woodland; V = Vulnerable; M = Migratory

Appendix C

Identification Guidelines for Cumberland Plain Woodland under the EPBC Act

Flowchart of key diagnostic features and condition thresholds to identify the Cumberland Plain Shale Woodlands and Shale-Gravel Transition Forest ecological community



Notes: See page 10 for notes.

Appendix D

Assessment of the Likelihood of Occurrence of Threatened Species

Table D.1 Likelihood of Occurrence of Threatened Plant Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
Apocynaceae	*Cynanchum elegans*	White-flowered Wax Plant	E	E	1	The White-flowered Wax Plant usually occurs on the edge of dry rainforest vegetation. Other associated vegetation types include littoral rainforest; Coastal Tea-tree *Leptospermum laevigatum* – Coastal Banksia *Banksia integrifolia subsp. integrifolia* coastal scrub; Forest Red Gum *Eucalyptus tereticornis* aligned open forest and woodland; Spotted Gum *Corymbia maculata* aligned open forest and woodland; and Bracelet Honeymyrtle *Melaleuca armillaris* scrub to open scrub.	Unlikely. The subject site does not provide suitably sheltered sites that could support the species. The vegetation along Reedy Creek is very disturbed and heavily accessed by livestock.
Apocynaceae	*Marsdenia viridiflora subsp. viridiflora*	Marsdenia viridiflora subsp. viridiflora population in the Bankstown, Blacktown, Camden, Campbelltown, Fairfield, Holroyd,	E2	-	23	Recent records are from Prospect, Bankstown, Smithfield, Cabramatta Creek and St Marys. Previously known north from Razorback Range. Grows in vine thickets and open shale woodland.	Unlikely. The open shale woodland on the subject site is heavily accessed by cattle and does not support many native understorey species.

Table D.1 Likelihood of Occurrence of Threatened Plant Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
Fabaceae (Faboideae)	*Dillwynia tenuifolia*	Liverpool and Penrith LGAs. -	V	V	64	It has a core distribution within the Cumberland Plain, where it may be locally abundant within scrubby, dry heath areas within Castlereagh Ironbark Forest and Shale/Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in the ecotone between these areas and Castlereagh Scribbly Gum Woodland. Flowers sporadically from August to March.	Unlikely. No suitable habitat on the subject site. Soils are not gravely and do not support Castlereagh Scribbly Gum Woodland or Shale/Gravel Transition Forest. No *Dillwynia* species were recorded during surveys of the subject site.
Fabaceae (Faboideae)	*Pultenaea parviflora*	-	E	V	34	May be locally abundant, particularly within scrubby/dry heath areas within Castlereagh Ironbark Forest and Shale Gravel Transition Forest on tertiary alluvium or laterised clays. May also be common in ecotone between these communities and Castlereagh Scribbly Gum Woodland. *Eucalyptus fibrosa* is usually the dominant canopy species. *E.*	Unlikely. No suitable habitat on the subject site. Soils are not gravely and do not support Castlereagh Scribbly Gum Woodland or Shale/Gravel Transition Forest. No *Pultenaea*

Table D.1 Likelihood of Occurrence of Threatened Plant Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
						globoidea, *E. longifolia*, *E. parramattensis*, *E. sclerophylla* and *E. sideroxylon* may also be present or co-dominant, with *Melaleuca decora* frequently forming a secondary canopy layer. Associated species may include *Allocasuarina littoralis*, *Angophora bakeri*, *Aristida* spp. *Banksia spinulosa*, *Cryptandra* spp., *Daviesia ulicifolia*, *Entolasia stricta*, *Hakea sericea*, *Lissanthe strigosa*, *M. nodosa*, *Ozothamnus diosmifolius* and *Themeda australis* . Often found in association with other threatened species such as *Dillwynia tenuifolia*, *Dodonaea falcata*, *Grevillea juniperina*, *Micromyrtus minutiflora*, *Persoonia nutans* and *Styphelia laeta*. Flowering may occur between August and November.	species were recorded during surveys of the subject site.
Fabaceae (Mimosoideae)	*Acacia pubescens*	Downy Wattle	V	V	56	Associated with on Cumberland Plain Woodlands, Shale/Gravel Forest and Shale/ Sandstone Transition Forest. The soils are characteristically gravely soils, often with	Possible. Suitable habitat present; however, the woodland on the subject site is heavily accessed

Table D.1 Likelihood of Occurrence of Threatened Plant Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
						ironstone.	by cattle and does not support many native understorey species.
Fabaceae-Faboideae	*Pultenaea pedunculata*	Matted Bush-pea	E1	-	2	The Matted Bush-pea occurs in a range of habitats. NSW populations are generally among woodland vegetation but plants have also been found on road batters and coastal cliffs.	Possible. Suitable habitat present; however, the woodland on the subject site is heavily accessed by cattle and does not support many native understorey species. No *Pultenaea* species were recorded during surveys of the subject site.
Lobeliaceae	*Isotoma sessiliflora*	-	E1	Ex	7	Known to grow in damp places, on the Cumberland Plain, including freshwater wetland, grassland/alluvial woodland and an alluvial woodland/shale plains woodland (Cumberland Plain Woodland) ecotone. Currently known from only two adjacent sites on a single private property at Erskine Park in the Penrith LGA. Previous sightings	Unlikely. The vegetation along Reedy Creek is very disturbed and heavily accessed by livestock. Other wet sites on the subject site (associated with dams) are generally devoid of

Table D.1 Likelihood of Occurrence of Threatened Plant Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
						are all from western Sydney, at Homebush and at Agnes Banks. Possibly outcompeted when overgrown by Couch Grass *Cynodon dactylon*.	wetland vegetation. Couch Grass is a widespread and abundant understorey species on the subject site.
Marsiliaceae	*Pilularia novae-hollandiae*	Austral Pilwort	E1	-	1	Austral Pillwort is a semi-aquatic fern, resembling a small fine grass. Austral Pillwort grows in shallow swamps and waterways, often among grasses and sedges. It is most often recorded in drying mud as this is when it is most conspicuous.	Unlikely. The vegetation along Reedy Creek is very disturbed and heavily accessed by livestock. Other wet sites on the subject site (associated with dams) are generally devoid of wetland vegetation.
Moraceae	*Streblus pendulinus*	Siah's Backbone, Sia's Backbone, Isaac Wood	-	E	0	Siah's Backbone is a tree or large shrub that grows to 6 m in height. On the Australian mainland, Siah's Backbone is found in warmer rainforests, chiefly along watercourses. The altitudinal range is from near sea level to 800 m above sea level. The species grows in well developed	Unlikely. No suitable habitat present on the subject site. Has not been recorded during surveys of the subject site.

Table D.1 Likelihood of Occurrence of Threatened Plant Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
						rainforest, gallery forest and drier, more seasonal rainforest.	
Myrtaceae	*Callistemon linearifolius*	Netted Bottlebrush	V	-	1	Recorded from the Georges River to Hawkesbury River in the Sydney area, and north to the Nelson Bay area of NSW. For the Sydney area, recent records are limited to the Hornsby Plateau area near the Hawkesbury River. Grows in dry sclerophyll forest on the coast and adjacent ranges.	Unlikely. The subject site is not associated with the Hawkesbury or Georges River and no *Callistemon* species were recorded during surveys of the subject site.
Myrtaceae	*Micromyrtus minutiflora*	-	E1	V	1	Grows in Castlereagh Scribbly Gum Woodland, Ironbark Forest, Shale/Gravel Transition Forest, open forest on tertiary alluvium and consolidated river sediments.	Unlikely. No suitable habitat on the subject site. Soils are not gravely and do not support Castlereagh Scribbly Gum Woodland or Shale/Gravel Transition Forest. No *Micromyrtus* species were recorded during surveys of the subject site.
Orchidaceae	*Pterostylis gibbosa*	Illawarra	-	E	0	Found in open forest or woodland, on flat or	Unlikely. It is thought to

Table D.1 Likelihood of Occurrence of Threatened Plant Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
		Greenhood, Rufa Greenhood, Pouched Greenhood				gently sloping land with poor drainage.	be extinct in western Sydney which is the area where it was first collected in 1803.
Orchidaceae	*Pterostylis saxicola*	Sydney Plains Greenhood	-	E	2	Most commonly found growing in small pockets of shallow soil in depressions on sandstone rock shelves above cliff lines. The vegetation communities above the shelves where *Pterostylis saxicola* occurs are sclerophyll forest or woodland on shale/sandstone transition soils or shale soils.	Unlikely. No suitable habitat on the subject site.
Proteaceae	*Grevillea juniperina subsp. juniperina*	Juniper-leaved Grevillea	V	-	198	Restricted to red sandy to clay soils containing lateric gravels on Wianamatta Shale and Tertiary alluvium in Cumberland Plain Woodland and Castlereagh Woodland.	Unlikely. Soils are not suitably gravely. The species has not been recorded during surveys of the subject site.
Proteaceae	*Grevillea parviflora subsp. parviflora*	Small-flower Grevillea	-	V	13	Grows in sandy or light clay soils usually over thin shales. Occurs in a range of vegetation types from heath and shrubby woodland to open forest.	Possible. Suitable habitat present; however, the woodland on the subject site is heavily accessed

Table D.1 Likelihood of Occurrence of Threatened Plant Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
							by cattle and does not support many native understorey species. No *Grevillea* species were recorded during surveys of the subject site.
Proteaceae	*Persoonia nutans*	Nodding Geebung	E1	E	23	Confined to aeolian and alluvial sediments and occurs in a range of sclerophyll forest and woodland vegetation communities, with the majority of individuals occurring within Agnes Banks Woodland or Castlereagh Scribbly Gum Woodland.	Unlikely. No suitable habitat on the subject site.
Rhamnaceae	*Pomaderris brunnea*	Rufous Pomaderris	V	V	0	Brown Pomaderris grows in moist woodland or forest on clay and alluvial soils of flood plains and creek lines	Unlikely. The subject site does not provide suitably sheltered sites that could support the species. The vegetation along Reedy Creek is very disturbed and heavily accessed by livestock.
Thymelaeaceae	*Pimelea curviflora*	-	V	V	0	Occurs on shaley/lateritic soils over	Unlikely. The woodland

Table D.1 Likelihood of Occurrence of Threatened Plant Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
	var. curviflora					sandstone and shale/sandstone transition soils on ridgetops and upper slopes amongst woodlands.	on the subject site is heavily accessed by cattle and does not support many native understorey species. The dominance of perennial weedy grasses such as Kikuyu and Couch Grass is likely to have limited the availability of suitable habitat for the species.
Thymelaeaceae	*Pimelea spicata*	Spiked Rice-flower	E	E	65	In western Sydney, it occurs on an undulating topography of well structured clay soils, derived from Wianamatta shale. It is associated with Cumberland Plain Woodland (CPW), in open woodland and grassland often in moist depressions or near creek lines. Has been located in disturbed areas that would have previously supported CPW	Possible. Suitable habitat present; however, the woodland on the subject site is heavily accessed by cattle and does not support many native understorey species.

E1 = Endangered (TSC Act); E2 = Endangered Population (TSC Act); E = Endangered (EPBC Act); V = Vulnerable; Ex = Extinct

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
GASTROPODS							
Helicidae	*Meridolum corneovirens*	Cumberland Plain Land Snail	E1	-	249	Lives in a restricted area in the Cumberland Plain west of Sydney under litter of leaves, bark and logs or in loose soil around grass clumps feeding on fungus. Primarily inhabits Cumberland Plain Woodland.	Possible. Occurrence would likely be limited to Forest Red Gum near Reedy Creek, and within the swamp area at the south eastern Wallgrove Road frontage.
FISH							
Percichthyidae	*Macquaria australasica*	Macquarie Perch	-	E	0	Prefers clear water and deep, rocky holes with lots of cover comprised of aquatic plants, large boulders, debris and overhanging banks.	Unlikely. No suitable habitat within the subject site. Not recorded during targeted fauna survey
Retropinnidae	*Prototroctes maraena*	Australian Grayling	-	V	0	Inhabits clear, gravel-bottomed streams with alternating pools and riffles, and granite outcrops but has also been present in a muddy-bottomed, heavily silted habitat	Unlikely. No suitable habitat within the subject site. Not recorded during targeted fauna survey
AMPHIBIANS							
Hylidae	*Litoria aurea*	Green and Golden Bell Frog	E1	V	24	Marshes, dams, stream sides, particularly those containing bullrushes	Unlikely. This species has not been recorded in the locality

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
						or spikerushes; unshaded water bodies free of *Gambusia* form optimum habitat; vegetation and/or rocks are needed for sheltering.	for many decades. Suitable habitat present on the subject site but not recorded during targeted fauna survey.
Hylidae	*Litoria raniformis*	Growling Grass Frog, Southern Bell Frog, Green and Golden Frog, Warty Swamp Frog	-	V	0	Found in or around permanent or ephemeral swamps or billabongs along floodplains and river valleys	Unlikely. No suitable habitat within the subject site. Not recorded during targeted fauna survey
Limnodynastidae	*Helioporus autraliacus*	Giant Burrowing Frog	-	V	0	Found in heath, woodland and open forest with sandy soils.	Unlikely. No suitable habitat within the subject site. Not recorded during targeted fauna survey
Myobactrachidae	*Mixophyes iteratus*	Giant Barred Frog, Southern Barred Frog	-	E	0	Inhabit deep, damp leaf litter in rainforests, moist eucalypt forest and nearby dry eucalypt forest, at elevations below 1000 m.	Unlikely. No suitable habitat within the subject site. Not recorded during targeted fauna survey
REPTILES							
Elapidae	*Hoplocephalus bungaroides*	Broad-headed Snake	-	V	0	Shelters in rock crevices and under flat sandstone rocks on exposed cliff	Unlikely. No suitable habitat within the subject site. Not

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
						edges or in hollows in large trees within 200 m of escarpments	recorded during targeted fauna survey.
BIRDS							
Apodidae	*Hirundapus caudacutus*	White-throated Needletail	-	M,C,J,K	0	Forages aerially over a variety of habitats usually over coastal and mountain areas with a preference for wooded areas	Possible. Limited suitable habitat within the subject site. Could fly over from time to time. Not recorded during targeted fauna survey
Apodidae	*Apus pacificus*	Fork-tailed Swift	-	M,C,J,K	0	Common migrant throughout mainland Australia	Possible. Limited suitable habitat within the subject site. Could fly over from time to time. Not recorded during targeted fauna survey
Ardeidae	*Botaurus poiciloptilus*	Australasian Bittern	-	E	0	Favours permanent freshwater wetlands with tall, dense vegetation, particularly bullrushes (*Typha* spp.) and spikerushes (*Eleoacharis* spp.).	Unlikely. No suitable habitat exists for the species on the site, no records in the locality
Ardeidae	*Ardea modesta*	Great Egret, White Egret	-	M,C,J	0	Reported in a wide range of wetland habitats including river margins, lakes, salt marshes, estuarine mudflats, tidal	Confirmed.

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
						streams and mangrove swamps	
Ardeidae	*Ardea ibis*	Cattle Egret	-	M,C,J	0	Tend to forage in pasture, marsh, grassy road verges, rain puddles and croplands	Confirmed.
Accipitridae	*Lophoictinia isura*	Square-tailed Kite	V	-	2	Diverse habitats from woodlands to timbered watercourses	Confirmed. Limited suitable habitat within the subject site. Could fly over from time to time. Not recorded during targeted fauna survey
Accipitridae	*Haliaeetus leucogaster*	White-bellied Sea-Eagle	-	M,C	0	Forages over large open fresh or saline waterbodies, coastal seas and open terrestrial areas. Breeding habitat consists of tall trees, mangroves, cliffs, rocky outcrops, silts, caves and crevices and is located along the coast or major rivers.	Possible. Limited suitable habitat within the subject site. Could Not recorded during targeted fauna survey.
Accipitridae	*Erythrotriorchis radiatus*	Red Goshawk	CE	V	0	Red Goshawks inhabit open woodland and forest, preferring a mosaic of vegetation types, a large population of birds as a source of food, and	Unlikely. Limited suitable habitat within the subject site. Not recorded during targeted fauna survey.

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
						permanent water, and are often found in riparian habitats along or near watercourses or wetlands. In NSW, preferred habitats include mixed subtropical rainforest, *Melaleuca* swamp forest and riparian *Eucalyptus* forest of coastal rivers.	
Accipitridae	*Hieraaetus morphnoides*	Little Eagle	V	-	21	Inhabits open eucalypt forest, woodlands or open woodland.	Possible. Some potential foraging habitat exists on the subject site as part of a larger foraging range. Not likely to be a frequent visitor.
Rostratulidae	*Rostratula australis*	Australian Painted Snipe	-	V, M	0	Found in covered grassy, low scrub or open timber ares on fringes of swamps, dams and marshes. Typical sites include those with rank emergent tussocks of grass, sedges, rushes or reeds, or samphire; often with scattered clumps of lignum *Muehlenbeckia* or canegrass or	Unlikely. Wetlands on the subject site are devoid of good quality fringing vegetation and nearby timbered sites are not well protected from foxes and other feral predators. Not recorded during targeted fauna survey

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
						sometimes tea-tree (*Melaleuca*)	
Scolopacidae	*Gallinago hardwickii*	Latham's Snipe, Japanese Snipe	-	M,C,J,K	0	Inhabits a variety of permanent and ephemeral wetlands, preferring wetlands with nearby cover, including wetland grasses and open wooded swamps	Possible. Limited suitable habitat within the subject site. Not recorded during targeted fauna survey
Cacatuidae	*Callocephalon fimbriatum*	Gang-gang Cockatoo	V	-	1	In summer, generally found in tall mountain forests and woodlands, particularly in heavily timbered and mature wet sclerophyll forests. In winter, may occur at lower altitudes in drier more open eucalypt forests and woodlands, and often found in urban areas. Favours old growth attributes for nesting and roosting.	Unlikely. Limited suitable foraging habitat within the subject site. No suitable roosting habitat. Not recorded during targeted fauna survey
Psittacidae	*Glossopsitta pusilla*	Little Lorikeet	V	-	1	Forages primarily in the canopy of open *Eucalyptus* forest and woodland, yet also finds food in *Angophora*, *Melaleuca* and other tree species. Riparian habitats are particularly used, due to higher soil fertility and hence	Unlikely. Although the species can forage in isolated trees in paddocks, the woodland vegetation is not well protected and the trees, due to their condition and age, are unlikely

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
						greater productivity.	to flower abundantly or reliably.
Psittacidae	*Lathamus discolor*	Swift Parrot	E1	E	15	Migrates between Tasmania and the mainland. Occurs where there are abundant eucalypt flowers or lerp infestations. Favours winter flowering eucalypt species including Swamp Mahogany, Spotted Gum, Red Bloodwood, Mugga Ironbark and White Box	Unlikely. Although the species can forage in isolated trees in paddocks, the woodland vegetation is not well protected and the trees, due to their condition and age, are unlikely to flower abundantly or reliably.
Tytonidae	*Tyto novaehollandiae*	Masked Owl	V	-	2	Occurs in forests, open woodlands, farmlands with large trees. Roosts in large hollow	Possible. Limited suitable habitat within the subject site. Not recorded during targeted fauna survey
Meropidae	*Merops ornatus*	Rainbow Bee-eater	-	M,J	0	Occurs mainly in open forests and woodlands, shrublands but can occur in various cleared or semi-cleared habitats, including farmland and areas of human habitation. However, occurs chiefly at suitable breeding places in areas of sandy or loamy soil: sand-ridges, riverbanks, sand-pits,	Unlikely. The subject site provides limited habitat for the species and potential breeding sites along Reedy Creek is not currently well protected from feral predators.

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
						occasionally coastal cliffs.	
Dasyornithidae	*Dasyornis brachypterus*	Eastern Bristlebird	-	E	0	Inhabits dense, fire prone, low vegetation areas like heathy woodland, open woodland with heath understory or open forest with tussock grass understory	Unlikely. No suitable habitat within the subject site. Not recorded during targeted fauna survey.
Acanthizidae	*Chthonicola sagittata*	Speckled Warbler	V	-	1	Lives in a wide range of Eucalyptus dominated communities that have a grassy understorey, often on rocky ridges or in gullies. Typical habitat would include scattered native tussock grasses, a sparse shrub layer, some eucalypt regrowth and an open canopy. Large, relatively undisturbed remnants are required for the species to persist in an area. The diet consists of seeds and insects, with most foraging taking place on the ground around tussocks and under bushes and trees.	Unlikely. No suitable habitat on the subject site. There is a distinct lack of large native tussock grasses and there are no large areas of undisturbed remnant vegetation within the subject site or immediately adjacent to the subject site. The only record within the locality is located in Kemps Creek Nature Reserve.
Meliphagidae	*Anthochaera phrygia*	Regent	E4A	CE, M	9	Inhabits temperate woodlands and	Unlikely. Although the species

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
		Honeyeater				open forests, particularly Box-Ironbark Woodland and riparian forests of She-oak, with significantly large numbers of mature trees, high canopy cover and abundance of mistletoe. Feeds mainly on nectar and fruit from eucalypts and mistletoes and occasionally on insects. Requires shrubby understorey for nesting material. Nomadic movement of the species may depend on flowering and other resource patterns.	can forage in isolated trees in paddocks, the woodland vegetation is not well protected and the trees, due to their condition and age, are unlikely to flower abundantly or reliably.
Meliphagidae	*Melithreptus gularis gularis*	Black-chinned Honeyeater (eastern subspecies)	V	-	1	Drier eucalypt forests, woodlands, timber on water courses, often no understorey, scrubs. Favours ironbark woodlands on western slopes.	Unlikely. Limited suitable habitat within the subject site. Not recorded during targeted fauna survey
Neosittidae	*Daphoenositta chrysoptera*	Varied Sittella	V	-	24	The Varied Sittella is sedentary and inhabits most of mainland Australia. Inhabits eucalypt forests and woodlands, especially those containing rough-barked species and	Unlikely. No suitable habitat within the subject site.

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
						mature smooth-barked gums with dead branches, mallee and *Acacia* woodland.	
Rhipiduridae	*Rhipidura rufifrons*	Rufous Fantail	-	M	0	Found in rainforest, dense wet eucalypt and monsoon forests, paperbark and mangrove swamps and riverside vegetation	Unlikely. No suitable habitat within the subject site. Not recorded during targeted fauna survey
Monarchidae	*Myiagra cyanoleuca*	Satin Flycatcher	-	M	0	Wetter, denser forest, often at high elevations	Unlikely. Limited suitable habitat within the subject site. Not recorded during targeted fauna survey
Monarchidae	*Monarcha melanopsis*	Black-faced Monarch	-	M	0	Mainly occurs in rainforest ecosystems, including semi-deciduous vine-thickets, complex notophyll vine-forest, tropical (mesophyll) rainforest, subtropical (notophyll) rainforest, mesophyll (broadleaf) thicket/shrubland, warm temperate rainforest, dry (monsoon) rainforest and (occasionally) cool temperate rainforest. Can occur in nearby open	Unlikely. No suitable habitat within the subject site. Not recorded during targeted fauna survey

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
						eucalypt forests although these are usually wet sclerophyll forests. The Black-faced Monarch forages for insects among foliage, or catches flying insects on the wing.	
Petroicidae	*Petroica boodang*	Scarlet Robin	V	-	2	Lves in mature and regrowth dry eucalypt forests and woodlands. The understorey is usually open and grassy with few scattered shrubs. Scarlet Robin habitat usually contains abundant logs and fallen timber: these are important components of its habitat. In autumn and winter many Scarlet Robins live in open grassy woodlands, and grasslands or grazed paddocks with scattered trees.	Possible. However, the subject site lacks woody ground debris, which are important habitat components for the species. The woodland on the subject site is likely to be poor quality habitat for the species.
Petroicidae	*Petroica phoenicea*	Flame Robin	V	-	2	Prefers clearings or areas with open understoreys. The groundlayer of the breeding habitat is dominated by native grasses and the shrub layer may be either sparse or dense.	Unlikely. No suitable habitat within the subject site. Not recorded during targeted fauna survey

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
						Occasionally occurs in temperate rainforest, and also in herbfields, heathlands, shrublands and sedgelands at high altitudes.	
MAMMALS							
Dasyuridae	*Dasyurus maculatus*	Spotted-tailed Quoll	V	E	7	Occurs in wide variety of habitats in large remnants. Dens in tree hollows, hollow logs or rock crevices	Unlikely. Limited suitable habitat within the subject site. Not recorded during targeted fauna survey. Foxes are abundant in the area and at least two or three individuals were recorded on site in one night.
Phascolarctidae	*Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)*	Koala	V	V	4	Inhabit eucalypt woodlands and forests. Feed on the foliage of more than 70 eucalypt species and 30 non-eucalypt species, but in any one area will select preferred browse species.	Unlikely. No suitable habitat within the subject site. Not recorded during targeted fauna survey
Potoroidae	*Potorous tridactylus tridactylus*	Long-nosed Potoroo (SE	V	V	0	Inhabits coastal heaths and dry and wet sclerophyll forests. Dense	Unlikely. No suitable habitat within the subject site. Not

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
		mainland)				understorey with occasional open areas is an essential part of habitat, and may consist of grass-trees, sedges, ferns or heath, or of low shrubs of tea-trees or melaleucas. A sandy loam soil is also a common feature.	recorded during targeted fauna survey
Macropodidae	*Petrogale penicillata*	Brush-tailed Rock-wallaby	E	V	0	Inhabits outcrops and cliffs with complex structures	Unlikely. No suitable habitat within the subject site. Not recorded during targeted fauna survey
Pteropodidae	*Pteropus poliocephalus*	Grey-headed Flying-fox	V	V	70	Occurs in subtropical and temperate rainforests, tall sclerophyll forests and woodlands, heaths and swamps. Forage on nectar and pollen of native trees, especially *Eucalyptus*, *Melaleuca* and *Banksia*. Migrates in search of food.	Possible. Known roosting colony at Cabramatta Creek but little foraging resource on the subject site. Could potentially fly over the subject site from time to time.
Molossidae	*Mormopterus norfolkensis*	Eastern Freetail Bat	V	-	32	Occur in dry sclerophyll forest and woodland east of the Great Dividing Range	Tentatively identified from echolocation recordings. Some habitat within the subject site.

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
							Recorded in adjacent sites in 2007. Likely to forage over the western dam.
Vespertilionidae	*Chalinolobus dwyeri*	Large-eared Pied Bat, Large Pied Bat	-	V	0	Roosts in caves (near their entrances), crevices in cliffs, old mine workings and in the disused, bottle-shaped mud nests of the Fairy Martin (*Petrochelidon ariel*), frequenting low to mid-elevation dry open forest and woodland close to these features. Females have been recorded raising young in maternity roosts (c. 20-40 females) from November through to January in roof domes in sandstone caves and overhangs. They remain loyal to the same cave over many years.	Unlikely. The foraging habitat on the subject site is limited and is not suitably located near cliff lines and escarpments where the species prefers to roost. Not recorded during targeted fauna survey or elsewhere in the locality.
Vespertilionidae	*Falsistrellus tasmaniensis*	Eastern False Pipistrelle	V	-	10	Occurs in moist habitat with trees over 20m in height, hunting insects above or just below the tree canopy. Roosts in eucalypt hollows, under bark and in	Tentatively identified from echolocation recordings. Some habitat within the subject site. Recorded in adjacent sites in

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
						buildings. Hibernates in winter.	2007. Likely to forage over the western dam.
Vespertilionidae	*Miniopterus schreibersii oceanensis*	Eastern Bentwing-bat	V	-	55	Roosts mainly in caves but also in tunnels, mines or buildings. Non-breeding populations disperse within a 300 km range of maternity caves. Hunting for moths and other insects takes place in forested areas above the canopy.	Likely. Some habitat within the subject site. Recorded in adjacent sites in 2007. Likely to forage over the western dam.
Vespertilionidae	*Myotis macropus*	Southern Myotis	V	-	17	Found along the coast and roost in caves, mine shafts, tree hollows or dense foliage. Foraging for fish and insects occurs over streams and pools.	Confirmed. Likely to forage over the western dam.
Vespertilionidae	*Scoteanax rueppellii*	Greater Broad-nosed Bat	V	-	12	Usually roosts in tree hollows and forages for beetles and other insects or microbats along creek and river corridors in open woodland habitat and dry open forests	Tentatively identified from echolocation recordings. Some habitat within the subject site. Recorded in adjacent sites in 2007. Likely to forage over the western dam.

Table D.2 Likelihood of Occurrence of Threatened Fauna Species on the Subject Site

Family	Scientific Name	Common Name	Legal Status (TSC Act)	Legal Status (EPBC Act)	OEH Bionet Records within Locality	Habitat Requirements	Likelihood of Occurrence (unlikely, possible, likely, confirmed)
Muridae	*Pseudomys novaehollandiae*	New Holland Mouse	-	V	0	The New Holland Mouse has been found from coastal areas and up to 100 km inland on sandstone country. The species occurs in open heathland, open woodland with a heathland understorey and vegetated sand dunes.	Unlikely. No suitable habitat within the subject site. Not recorded during targeted fauna survey

NSW Status

E1 *Endangered (Threatened Species Conservation Act 1995)*

E2 *Endangered Population (Threatened Species Conservation Act 1995)*

E4A *Critically Endangered (Threatened Species Conservation Act 1995)*

V *Vulnerable (Threatened Species Conservation Act 1995)*

Commonwealth Status

C *Listed on China Australia Migratory Bird Agreement*

CE *Critically Endangered (Commonwealth EPBC Act 1999)*

E *Endangered (Commonwealth EPBC Act 1999)*

J *Listed on Japan Australia Migratory Bird Agreement*

K *Listed on Republic of Korea Australia Migratory Bird Agreement*

M *Migratory*

V *Vulnerable (Commonwealth EPBC Act 1999)*

Appendix E

Indicative BioBanking Credit Profile for the Project

BioBanking Credit Calculator

BioBanking credit report

This report identifies the number and type of credits required at a DEVELOPMENT SITE.

Date of report: 16/08/2013 Time: 2:12:08PM Tool version: 2.0

Development details

Proposal ID:	0057/2013/0697D
Proposal name:	8051 - Development Site (V1 original / V2 man.zones)
Proposal address:	1 Mountain St Epping NSW 2121
Proponent name:	Cumberland Ecology
Proponent address:	PO Box 2474 Carlingford Court NSW 2118
Proponent phone:	98681933
Assessor name:	David Robertson
Assessor address:	PO BOX 2474 Carlingford Court NSW 2118
Assessor phone:	9868 1933
Assessor accreditation:	0057

Improving or maintaining biodiversity

An application for a red flag determination is required for the following red flag areas

Red flag	Reason
Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	Vegetation type being > 70% cleared; or it contains an endangered ecological community;
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin	Vegetation type being > 70% cleared; or it contains an endangered ecological community;

The application for a red flag determination should address the criteria set out in the BioBanking Assessment Methodology. Please note that a biobanking statement cannot be issued unless the determination is approved.

Additional information required for approval:

- ☐ Change to percent cleared for a vegetation type/s
- ☐ Use of local benchmark
- ☐ Change negligible loss
- ☐ Expert report
- ☐ Predicted threatened species not on site
- ☐ Change threatened species response to gain (Tg value)

Ecosystem credits summary

Vegetation type	Area (ha)	Credits required	Red flag
Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin	9.68	172	Yes
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	3.10	55	Yes
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin	1.11	28	Yes
Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin	0.17	1	Yes
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin	0.17	1	Yes
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin	0.32	2	Yes
Total	14.55	259	

Credit profiles

1. Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin, (HN526)

Number of ecosystem credits required	30
CMA sub-region	Cumberland - Hawkesbury/Nepean
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	25-100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin, (HN526) Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin, (HN528) Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin, (ME018) Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin, (ME020)	Cumberland - Hawkesbury/Nepean Wollemi - Hawkesbury/Nepean Yengo - Hawkesbury/Nepean Cumberland - Sydney Metro Sydney Cataract - Sydney Metro

2. Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin, (HN528)

Number of ecosystem credits required	56
CMA sub-region	Cumberland - Hawkesbury/Nepean
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	25-100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin, (HN528) Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin, (HN526) Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin, (ME018) Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin, (ME020)	Cumberland - Hawkesbury/Nepean Wollemi - Hawkesbury/Nepean Yengo - Hawkesbury/Nepean Cumberland - Sydney Metro Sydney Cataract - Sydney Metro

3. Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin, (HN529)

Number of ecosystem credits required	173
CMA sub-region	Cumberland - Hawkesbury/Nepean
Minimum percent native vegetation cover class	0-10%
Minimum adjacent remnant area class	25-100 ha

Offset options - vegetation types	Offset options - CMA sub-regions
Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin, (HN529) Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin, (HN526) Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin, (HN528) Forest Red Gum - Rough-barked Apple grassy woodland on alluvial flats of the Cumberland Plain, Sydney Basin, (ME018) Grey Box - Forest Red Gum grassy woodland on shale of the southern Cumberland Plain, Sydney Basin, (ME019) Grey Box - Forest Red Gum grassy woodland on flats of the Cumberland Plain, Sydney Basin, (ME020)	Cumberland - Hawkesbury/Nepean Wollemi - Hawkesbury/Nepean Yengo - Hawkesbury/Nepean Cumberland - Sydney Metro Sydney Cataract - Sydney Metro

Species credits

Common name	Scientific name	Extent of impact	Number of species credits required
Large-footed Myotis (Breeding)	Myotis macropus (formally Myotis adversus)	0.00	36
Large-footed Myotis (Breeding)	Myotis macropus (formally Myotis adversus)	1.43	36